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ABSTRACT

This committee report contains an overview of the role of the National Science Foundation in the federal management of scientific and technical information (STINFO), with an emphasis on understanding present activities through an historical perspective. Discussed are STINFO's functions, authorities, accomplishments, and problems. The report records a growing recognition of scientific and technical information as a valuable national resource and a concomitant concern with its availability in both the public and private sectors. In order to increase the effectiveness of federal scientific and technical information activities, the report recommends a stronger leadership for coordination and minimization of duplication of effort. Among the appendices are: (1) list of acronyms for key STINFO organizations, (2) chronology of selected events, (3) synopses of major reports, (4) science information program monetary obligations, (5) Dr. Burchinal's paper on national coordination of scientific and technical information (1974), and (5) bibliography. (STS)

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ED139373

94th Congress
2d Session

COMMITTEE PRINT

# FEDERAL MANAGEMENT OF SCIENTIFIC AND TECHNICAL INFORMATION (STINFO) ACTIVITIES: THE ROLE OF THE NATIONAL SCIENCE FOUNDATION

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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OF THE

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UNITED STATES SENATE

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## FOREWORD

The availability of information reflecting scientific and technical developments for use by public and private sector decisionmakers, planners, and researchers has become a matter of national concern. In order to obtain a current perspective on the management approaches and mechanisms within the Federal Government, a carefully documented overview study has been prepared by the Congressional Research Service of the Library of Congress in accordance with guidelines set forth by the Special Subcommittee on the National Science Foundation.

In reviewing the evolution of scientific and technical information organizations and services, and those related oversight actions taken within the legislative and executive branches of the Federal government, it is significant that many of the problems and action alternatives identified a number of years ago still are worthy of consideration. At this juncture in our Nation's history, with the bicentennial celebration upon us, this reexamination of a valuable national resource is both timely and of a substance to impact our future planning. I am pleased to be able to make this report available from the Committee on Labor and Public Welfare.

HARRISON A. WILLIAMS, JR.,
*Chairman.*

## LETTER OF TRANSMITTAL

U.S. SENATE,
COMMITTEE ON LABOR AND PUBLIC WELFARE,
*Washington, D.C.*

Hon. HARRISON A. WILLIAMS,
*Chairman, Senate Committee on Labor and Public Welfare, U.S. Senate, Washington, D.C.*

DEAR MR. CHAIRMAN: In the past few years, the Special Subcommittee on the National Science Foundation has examined some of the particular issues surrounding our structures for research and development, and the complex processes involved in transferring the products of government research into meaningful benefits for our society. The importance of scientific and technical information has emerged previously in the congressional examination of science and technology organizations, but only recently have we become aware that international and industrial trends in information networks have enhanced the value of our scientific information resources. This new attention to information as a national resource, however, has also revealed serious weaknesses in our infrastructure for developing and utilizing this valuable resource.

As noted in our Subcommittee's final report for the first session of the 93rd Congress, we had originally requested the Congressional Research Service to prepare studies on the National Science Foundation as background for our annual N.S.F. authorization hearings. Our investigation into budget reductions being imposed on the Office of Science Information Service and the abolition of the Science Information Council subsequently revealed an array of serious issues surrounding the management and support of scientific and technical information.

We therefore followed up our initial overview with a specific request to C.R.S. to analyze these questions and look for some answers. The accompanying background study, oriented toward a classification of policy alternatives, is the result of that analysis and reveals that some important choices still lie ahead. Before we make decisions that shape the future directions of Federal scientific and technical information systems, the Special Subcommittee would like to receive recommendations from the scientific community and information specialists as to how these alternatives can best be acted upon.

For this purpose, we recommend that the C.R.S. study be published as a Committee Print, and receive wide distribution. The publication is intended to serve as a focal point for action recommendations from those persons engaged in all parts of the scientific and technical information process. We would like to invite their comments and urge

them to bring their concerns to our attention so that we may plan a legislative program to meet what we see as serious needs in this area.

Ultimately, we hope to introduce legislation based upon our continued investigation which will provide for improved management and coordination to effectively handle scientific and technical information.

Sincerely,

EDWARD M. KENNEDY,
*Chairman, Special Subcommittee*
*on the National Science Foundation.*

## LETTER OF TRANSMITTAL

THE LIBRARY OF CONGRESS,
CONGRESSIONAL RESEARCH SERVICE,
*Washington, D.C.*

Hon. EDWARD M. KENNEDY,
*Chairman, Special Subcommittee on the National Science Foundation, Committee on Labor and Public Welfare, U.S. Senate, Washington, D.C.*

DEAR MR. CHAIRMAN: I am pleased to transmit this report entitled "Federal Management of Scientific and Technical Information (STINFO) Activities: The Role of the National Science Foundation," prepared at the request of the Special Subcommittee on the National Science Foundation, Committee on Labor and Public Welfare, of the United States Senate.

The study examines the role of the Federal Government, and in particular the National Science Foundation, in managing and monitoring scientific and technical information (STINFO) activities in both the public and private sectors.

It contains an overview of the conceptual and factual information essential to an understanding of this complex subject area, including a review of salient developments during the past two decades. Following an analysis of the role performed by the National Science Foundation in encouraging and often funding selected STINFO systems and services, the study provides a retrospective look at the full range of studies, policy-level decisions, and organizational actions affecting the evolution of the STINFO community in the period 1950–1975. Congressional efforts to stimulate and support, as well as occasionally scrutinize, these scientific and technical information services are presented. A series of appendices, containing selected background information, are attached. It should be noted that this study, in accordance with directions received from the Special Subcommittee, is designed as a concise, highlighted overview, not a definitive treatment of this complex subject area.

The study was prepared at the direction of the staff of the Special Subcommittee by Robert L. Chartrand, our Specialist in Information Sciences, and Rosemary A. Chalk, Analyst in Social Sciences, both of the Science Policy Research Division. The manuscript was reviewed by Walter A. Hahn, Assistant Division Chief and Senior Specialist in

Science and Technology, and Langdon T. Crane, Specialist in Science and Technology, both of the Science Policy Research Division. This contribution was coordinated and reviewed by Ms. Anne Strauss of the Special Subcommittee staff, and Dr. Steven Ebbin, consultant to the Special Subcommittee.

On behalf of the Congressional Research Service, may I express my appreciation for the opportunity to undertake this challenging and timely assignment.

Sincerely,

LESTER S. JAYSON,
*Director.*

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# FEDERAL MANAGEMENT OF SCIENTIFIC AND TECHNICAL INFORMATION (STINFO) ACTIVITIES:

## THE ROLE OF THE NATIONAL SCIENCE FOUNDATION

Robert L. Chartrand
Specialist in Information Sciences
and
Rosemary A. Chalk
Analyst in Science and Technology
Science Policy research Division

May 1, 1975



65-916 O - 76 - 2

## INTRODUCTION

In the period since the Second World war, the Nation has engaged in strenuous efforts to capitalize upon the strength derived from its many technological triumphs. With the urgency demanded by wartime needs, enormous resources -- money, materiel, human expertise -- were allocated to solve many problems and develop a wide range of new tools and techniques. These advances, such as the development of aerospace technology and a nuclear power capability, led to the generation of vast amounts of information in different forms -- narrative, statistical, and graphic -- as well as state-of-the-art advances in hardware and software, and the training of a new kind of sophisticated work force, both professional and non-professional.

Those persons responsible for the spectrum of research and development essential to these technological endeavors recognized early on that a "system" must be established whereby the data resulting from these efforts could be collected, catalogued, and made accessible to authorized users. In amplication of this definition, scientific and technical information (STINFO) activities were designed to reflect both on-going research and development and R & D results; man-machine systems featuring "networking"; an array of computer and microform hardware and software; plus those retrieval and dissemination functions related to technology transfer. Today there appears to be equal emphasis on the establishment of specially structured files containing essential elements of scientific and technical information as well as continued growth in abstracting and indexing services. Furthermore, the growing interests and skills of potential user groups have necessitated the establishment of fast,

accurate, low-cost, and above all responsive information systems. In particular, the STINFO concept stresses serving the researcher during every stage of his exploratory undertaking: the initial literature search, information exchange reflecting on-going projects, and dissemination of final results.

During the early sixties in particular, both congressional and executive branch concern about the creation and utilization of such data files was evidenced in a series of hearings and legislative reports, plus studies prepared at the request of the Federal Council for Science and Technology (FCST). This concern, building over a period of years, eventually resulted in the establishment of the so-called "STINFO" (Scientific and Technical Information) offices within most Federal departments and agencies. Three underlying reasons may be offered for this latter action:

1. All possible benefit must result from our scientific R & D programs and projects, many of which involved heavy funding;
2. A government-wide, "standardized" information structure understood and supported by top management must be created to provide a focus for coordination; and
3. The exchange of both on-going and completed research data -- increasingly interdisciplinary in nature -- between public and private sector elements must be facilitated in order to optimize planning for more efficiency and effectiveness in R & D and to reduce duplication of effort, thus facilitating public and private utilization of R & D products and services.

Because of its chartered responsibilities for carrying out those policies related to the promotion and communication of scientific research, the National Science Foundation (NSF) from its beginnings in 1950 has been authorized and directed to play an assortment of roles in the area of scientific and technical information. Rather than directly provide or operate information services, the Foundation's directors chose instead to support and monitor those systems already active elsewhere in the Federal Government and private sector, or to "midwife" those systems which featured the mechanization of formerly manual abstracting and indexing services. The costs of distributing the information produced through an NSF-sponsored research project were often included in the research grant itself, rather than allotted to supporting a central disseminating system. These costs, therefore, are difficult to measure or evaluate. The record shows that NSF's major interest has been to promote the publication of R & D results in the scientific literature, in many instances augmented by the creation of a computerized reference list which shows on-going research. Relatively little attention has been given to the creation of structured, machine-readable files containing basic physical science data, or the retrieval of information on developmental projects. In other words, the services developed by NSF are of greater use to the basic research scientists or librarians than other potential user groups. 1/ Even though scientific and technical research results are important and necessary to reflect the progress in R & D, only

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1/ The record of the NSF Office of Science Information Service (OSIS) previous achievements in the area of scientific information is described by Dr. Lee Burchinal in his presentation to the American Society for Information Science, included here as Appendix E.

sporadic attention has been given by any agency or advisory group to the network of systems through which the scientist or other user retrieves these results. "Information" is viewed generally as an intangible commodity, and its distribution and retrieval systems are not recognized as being in the same class with exotic hardware such as space vehicles, nuclear reactors, or advanced submersibles. Nor has there been a concerted effort to develop methods for broadening the utility of information systems. In order to enhance management and monitoring of R & D activities, greater flexibility dealing with categories of information must be achieved. These considerations tend to reinforce the view that information itself is a national resource, much like energy, to be used for the public good, private gain, and in some cases international barter. This concept was further developed in a recent report prepared by the Organization for Economic Co-operation and Development, commonly referred to as the Anderla report 2/.

Although several governmental echelons were involved in STINFO-type activities -- top level policy generators, the planning-programming-budgeting cadre, R & D managers (within departments and agencies), line personnel actually handling the R & D projects (both inside and outside of government), and the STINFO service groups per se -- no commonality of purpose was evident... a purpose ideally comprised of such elements as:

o Maintaining non-duplicative information services at minimum cost

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2/ Organization of Economic Co-operation and Development. Information in 1985: A forecasting study of information needs and resources. Prepared by Georges Anderla. 1973. 131 p.

- o Providing selective access to critical information
- o Ensuring retention of essential data emanating from R & D undertaken in the national interest
- o Facilitating knowledge spread in order to minimize redundant R & D endeavors
- o Assisting planners responsible for policy and program determination and resource allocation
- o Creating a "storehouse" of knowledge for technology transfer.

Fulfillment of these component objectives in turn could materially aid sustained interaction between the policy makers, the operating agencies and their private sector counterparts, and the host of peripheral users of the system.

In order to provide a framework helpful to understanding how the United States Government approached the problem of "managing" its scientific and technical information output, it is advisable to go back to the year 1957. With the advent of Sputnik I, a constant reminder of a broader competition, the requirement to formalize our policy formulation procedures and organizations for science was acknowledged. 3/ Late in the 1950's, the President's Science Advisory Committee (PSAC) and the position of a White House "Science Adviser" were created. Soon thereafter, the National Defense Education Act (NDEA) was passed,

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3/ Executive Order 10807, March 13, 1959, establishing the Federal Council for Science and Technology. See also the text of the radio and television address of President Eisenhower on science in national security, November 7, 1957. Both these documents are included in the committee print "The Office of Science and Technology", published in March 1967 by the House Committee on Government Operations.

providing for the establishment of a Science Information Council (SIC) and an Office of Science Information Service (OSIS) within the National Science Foundation. Concurrent with these milestone actions were the congressional hearings on the organization and coordination of science information activities in the Federal Government conducted by the Humphrey Subcommittee of the Senate Committee on Government Operations.

Next to emerge during the executive-legislative point-counterpoint was the founding of the Federal Council for Science and Technology, an interagency liaison and coordinating body with the Science Adviser as Chairman. Its major areas of concentration: to provide information about R & D activities in the member departments and agencies, to serve as the mechanism for drafting interagency plans, and to encourage cooperation between executive branch departments and agencies. Next came the establishment of an interdepartmental group called the Federal Advisory Committee on Scientific Information (FACSI). Within the Congress, the focus had narrowed, with the House Committee on Science and Astronautics holding hearings on the problem of dissemination of scientific information. Even at this early date, there was a growing realization that management attention at all levels must be captured and retained if STINFO functions were going to serve the scientific community and other groups in society. Supporters and users of STINFO services also became aware that in "leaner" R & D budget times, information systems were highly vulnerable to criticism and funding cuts. 4/ Gradually, those

4/ In FY 1967 and 1969, substantial cuts in the OSIS budget occurred, as shown in the table in Appendix D.

pressing for more optimal information services sought to involve not only the governmental agencies and private sector R & D performers, but the research library community and what came to be called Information Analysis Centers, as well 5/.

During the 1960's, much was said about enhancing the management function, but the companion area of concern -- i.e., improving the forward planning and post-project evaluation of R & D through utilization of derived information -- received only occasional attention. Between 1958 and 1963 a fresh perspective on the scientific information handling problem was provided by a series of studies prepared for the President's Science Advisory Committee -- the Baker Report (1958), the Crawford Report (1962), and the Weinberg Report (1963) 6/. Collectively, these recommendations stressed the establishment of specific entities to coordinate scientific and technical information services, with oversight responsibility at the highest levels of government, and direct program management through special offices located in the agencies. It should be noted that one "spur" to such thinking was the establishment within the Soviet Union of the massive staff of VINITI (The Soviet All-Union Institute of Scientific and Technical Information), dedicated to acquiring, structuring, and making available key data on world-wide scientific and technical developments.

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5/ In response to a growing awareness of the need to assist information users, the Federal Council Committee on Scientific and Technical Information (COSATI) established in 1967 a Panel on Information Analysis Centers, and sponsored a series of forums to focus attention on this type of new institution. See the COSATI forum proceedings entitled "The Management of Information Analysis Centers" (No. 72-1), January 1972.

6/ These various studies are synopsized in Appendix C.

With the passing of the years, and most certainly by the beginning of the 1970 decade, two major trends were discernible. First, while no one denied the importance in principle of STINFO activities, the subject was not one of pressing national criticality or visibility such as preserving the environment or (slightly later) the availability of energy resources. There was little or no political benefit for its champions, and the spokesmen of the early years -- Members of Congress Humphrey, Elliott, Daddario, Pucinski -- either had left the scene or become engrossed in other problem areas. Similarly, the attention given by the White House to such matters diminished with the passage of time. Secondly, as the bureaucracy accepted the early direction from its management, progress evolved in the reshaping and expansion of certain governmental repositories and related services. The Defense Documentation Center (DDC) was expanded, and the Department of Commerce enlarged its Office of Technical Services (OTS) into the facility now known as the National Technical Information Service (NTIS). The National Science Foundation encouraged the creation of the Smithsonian Science Information Exchange (SSIE) as well as the beginnings of the National Referral Center in the Library of Congress. Concurrently, the specialized information center concept which originated in the Weinberg Report and was endorsed by the Committee on Scientific and Technical Information (COSATI) was implemented through the development of more than 120 public and private "information analysis centers" funded by the Federal Government. In a number of instances, emphasis was placed on the utilization of advanced technology including computers and microforms.

In retrospect, these often conflicting patterns -- the diminishing of policy oversight activity and the growth of operating services -- suggest weaknesses which could be shored up, and a need for reorientating existing services to conform with the current trends in science. Almost ten years have passed without a major congressional scrutiny of this area. The pool of ideas and recommendations emanating from the earlier landmark studies is drying up, but certain of these still retain a measure of viability. There seems to be no encouragement for the formation of new groups capable of generating useful perspectives which could aid policymakers in the executive and legislative branches.

The National Science Foundation began early in its history to collect data on the costs of scientific and technical information activities, particularly as related to the total Federal research and development budget. But it was not until December 1961 that NSF published a survey and analysis of Federal STINFO costs, which were then estimated to be $75.9 million or approximately one percent of overall Federal obligations for research and development 7/. Since that first survey, different program and budget categories have been recognized as being related to STINFO, and the total level of activity has increased. (See Figure 1.) In its analysis of fiscal year 1972 Federal obligations for R & D, NSF designated 2.5 percent, $419 million, to STINFO 8/. Other surveys, conducted by the Committee on Scientific and Technical Information but not

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7/ U.S. National Science Foundation. Federal funds for science. Fiscal years 1960, 1961, and 1962. NSF 61-82. Volume X. Washington, U.S. Govt. Print. Off. See p. 56-67.

8/ -----. Federal funds for research, development, and other scientific activities. Fiscal years 1972, 1973, and 1974. NSF 74-300. Volume XXII. Washington, U.S. Govt. Print. Off. See p. 38.

yet released, have indicated that the total STINFO activity conducted through Federal funds is actually much larger ($914.3 million for fiscal year 1972), largely owing to differences in categorization and inclusion of STI costs among contractors identifiable as Government projects 9/. Both these estimates are probably conservative, and total obligations for STINFO functions could approximate two to three times the obligations reported.

Critics of STINFO services have noted that while funding for documentation collection and the creation of reference and information services has risen, there has been a percentage decrease in the allocation of Federal funds supporting publications telling about R & D, and the distribution systems allowing other types of access to the gathered data 10/. The Anderla report indicates that staff costs account for 60 to 80 percent of the budgets of scientific and technical libraries and documentation centers, and will continue to grow exponentially 11/. In order to conserve costs and handle the growing volume of information, his analysis shows that more attention should be given to developing carefully balanced machine-supported information systems, as a substitute for manual and mechanical processes 12/.

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9/ U.S. Office of Science and Technology. Federal agency obligations for managment, processing, and transfer of scientific and technical information, data, and technology. Fiscal years 1969 to fiscal year 1973. Report of the ad hoc group. September 1972. Volume I, II and III.

10/ Federal funds for research, development, and other scientific activities. Fiscal years 1972, 1973, and 1974. op. cit. p. 38.

11/ "Information in 1985", op. cit. See p. 83.

12/ Ibid.

Figure 1.

Trends in Federal obligations for scientific and technical information activities, by major categories

[Dollars in millions]

| Fiscal Year | Total | Publication and distribution | Documentation, reference and information services | Symposia and audiovisual media | R&D information sciences, documentation, and information system techniques, and devices | % of total R & D obligations |
|---|---|---|---|---|---|---|
| 1960... | $ 75.9 | $ 37.0 | $ 28.4 | $ 7.6 | $ 2.9 | 1 % |
| 1961... | 91.6 | 48.7 | 29.0 | 6.7 | 7.2 | 1 % |
| 1962... | 128.5 | 55.7 | 42.4 | 17.0 | 13.3 | 1 1/2% |
| 1963... | 164.5 | 67.7 | 64.0 | 21.0 | 11.9 | 1 1/2% |
| 1964... | * 203.2 | 59.9 | 90.3 | 22.7 | 12.6 | 1 1/2% |
| 1965... | 224.7 | 68.2 | 102.0 | 32.0 | 22.5 | 1 1/2% |
| 1966... | 277.7 | 82.7 | 124.6 | 22.5 | 48.0 | 1 1/2% |
| 1967... | 324.4 | 87.1 | 152.5 | 31.7 | 53.1 | 2 % |
| 1968... | 359.2 | 100.7 | 165.6 | 34.1 | 58.8 | 2 % |
| 1969.... | 362.5 | 96.0 | 170.9 | 31.8 | 63.7 | 2 % |
| 1970... | 386.8 | 98.9 | 198.1 | 32.6 | 62.1 | 2 % |
| 1971... | 397.6 | 106.0 | 193.8 | 32.8 | 65.0 | 2 1/2% |
| 1972... | 419.4 | 116.6 | 196.5 | 36.5 | 69.7 | 2 1/2% |
| 1973... | 437.9 | 122.6 | 198.0 | 37.9 | 79.4 | 2 1/2%(est.) |
| 1974(est.) | 467.9 | 131.6 | 217.0 | 40.4 | 78.9 | 2 1/2%(est.) |
| 1975(est.) | 485.0 | 141.0 | 224.2 | 42.1 | 77.6 | |

* Includes $17.2 million for management, which was reported separately from the other categories in 1964 only.

Source: Federal Funds for Research, Development, and Other Activities, Fiscal Years 1972, 1973, and 1974. Surveys of Science Resources Series, National Science Foundation. NSF 74-300. Volume XXI. December 1973. p. 38. Updated figures for fiscal year 1973, 1974 and 1975 provided via NSF on January 14, 1975, and will be printed in the next volume of Federal Funds...

The column on percentages has been added, and is based on the figures given in the Federal Funds series from 1960 to 1975.

Users of these systems and services have become more and more articulate, urging that traditional ways and means of facilitating access to collected information be broadened. Specifically, the consensus among scientists and engineers appeared to urge changes which would allow them to:

- o Be able to "browse" through collections, and not always have to ask for specific products
- o Have flexibility in asking for "output" in a variety of forms: indexes, digests, keyword-in-contest listings, abstracts, full text, statistics, and analyses
- o Access data files according to multiple (contextual or keyword) criteria, thereby enhancing selectivity in retrieval

Many observers today believe that the Federal management of STINFO activities has reached a "crossroads". Some indicate that great sums are being spent on R & D, and data resulting from these efforts are cascading forth, but a curious diminution of attention to managing, monitoring and applying this critical flow is threatening the effectiveness of the Federal R & D program. At the same time, industrial and international groups are organizing to meet the global demand for effective scientific information services. As part of an integrated and forward-looking framework for STINFO activity, these actions might provide stimulus and new resources for creating effective scientific information systems. Government policy objectives need to be developed for the following:

- o coordination of Federally-operated, Federally-supported, and private STINFO systems;
- o standardization both of requisite hardware-software components, and essential elements of information regularly exchanged;
- o R & D on information sciences and transfer of the findings to operating systems.

In the absence of adequate guidelines and unequal Federal participation, the public good resulting from Government-sponsored R & D could be diminished.

Although given increased responsibilities, the National Science Foundation's Office of Science Information Service has seen its budget reduced in recent years from $14 million to $5 million, with a concomitant staff decrease from 70 to 22. The Science Information Council and Committee on Scientific and Technical Information have disappeared, and there is no appreciable activity on the part of the National Science Board or the Federal Council for Science and Technology in this area.

This study will set forth the salient conceptual and factual background information essential to an understanding of this long-term, sometimes complex subject. This will be done in order to provide a framework for consideration by the Senate Special Subcommittee on the National Science Foundation, as it addresses the STINFO issue in response to charges of:

- o The existence of a STINFO "policy vacuum" within the Federal Government, and the critical need for a coordinated policy approach

- o The lack of real top-level support of existing STINFO programs, resulting in a dangerous weakening of an already minimal service capability
- o The increasing complexity and quantity of scientific and technical information, which is outstripping the capacities of existing documentation and analytical services

Following a discussion of the role of the National Science Foundation (Section II), Federal encouragement and examination of STINFO-type activities from 1950-1975 are reviewed in Section III. Congressional efforts to affect STINFO functions are noted in Section IV. Summarization of the findings resulting from this study are contained in Section V. A chronology of important happenings and a selected bibliography, as well as other appendices, also are included for ready reference.

## SECTION II: THE NATIONAL SCIENCE FOUNDATION

Two distinct approaches are offered here in examining the roles which the National Science Foundation has been called upon to perform in the management and funding of scientific and technical information. The first is an analysis of these roles on a functional basis, breaking out separate categories of activities. The second is a description of the legislative and executive authorities which have laid the groundwork for NSF responsibilities in this area. Through this comparison of mandated responsibilities and active functions emerges a more understandable picture of the strengths and weaknesses of the NSF program for scientific and technical information.

### Functional Roles in STINFO

Coordination and Policy Direction. The management of scientific and technical information, an important resource, requires a coordinated and consistent commitment both to maintaining a comprehensive collection of information "products" and ensuring user access to scientific information through effective retrieval and reference systems. Because of its unique mission as a supporter and "broker" for basic and applied research, the NSF is in a position to contract scientific research and to transfer the subsequent research products (primarily information) to potential users throughout the scientific community and the general society. In some cases the Foundation has actively carried out the responsibility of publishing the scientific or technical information produced by a research



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project which it has funded -- in other cases it has not 13/. But the process of interchange of scientific information between scientists and other users is not complete with the publication of results. A range of specific functions comprises the dissemination process:

1. Collecting and storing research products (STINFO) through manual and automated systems

2. Creating and maintaining both abstracting and indexing systems and specialized data files which facilitate access to collected materials

3. Ensuring user access to and awareness of various information systems

4. Establishing policies for user service charges

5. Performing R & D on advanced indexing, storing and retrieval technologies.

This range of functions might then be useful in analyzing the services encouraged and supported by NSF. At some point in the history of Federal involvement in STINFO activities, a consensus formed to not establish a single science information system, but rather to maintain and expand a network of separate systems which collected and "packaged" different types of information and served different groups of users. This decision encouraged pluralism and innovation, but also further fragmented

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13/ The responsibility for disseminating results of R & D was a principle set forth in the Weinberg Report in these words:

> Communication is an essential part of research; if an agency sponsors research in support of the agency mission, it ought also to allocate resources to support the communication necessary for effective conduct of that research. (p. 49)

The SATCOM report, prepared later, also acknowledges this responsiblity for communication of results in some of its recommendations. See, for example, p. 16 in the Summary Volume.

U.S. science information services. Reflecting the consensus, the NSF Directors made an early decision to not operate science information systems through the Foundation itself, but rather to support existing systems (both public and private) and to "fill in the cracks" through fragmented development of new systems, primarily by subsidy grants and research in new information technology. As a result, the roles of contributing to the development of separate systems and encouraging the transfer of R & D results into operational services are of greater relative importance in this present analysis of NSF functions as related to STINFO.

In seeking to coordinate or rationalize the emerging network of government-operated science information systems and Federally-funded private services, the Foundation must carry out a role filled with ambiguity and bureaucratic restrictions. With the demise of COSATI 14/ and other high-level groups active in the science information area, responsibility for coordinating inter-agency activities was transferred to NSF without a clear legislative mandate authorizing such action and without necessary funds or staff allocated solely to this role. There is little evidence to show that the abandonment of COSATI resulted from a careful study of needs for STINFO, or the potential impact on coordination and the STINFO programs. With no carrot and no stick, the NSF is in a poor position, indeed, to exercise responsibilities in developing a policy-guided network of science information services capable of meeting national needs. In the absence of science-oriented guidance through policy guidelines or legislation, individual agency information systems are attempting to make their

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14/ The summary minutes of the June 5, 1973 meeting of FCST state that at this meeting, the Council agreed COSATI should be discontinued and the responsibilities for coordination in the field of STINFO should be assumed by NSF. Furthermore, the public record does not reveal that FCST chose to examine the possible results of eliminating COSATI.

services self-sustaining (e.g., NTIS), often at the expense of the scientists or research groups that originally prepare the products collected in the information systems. These same scientists and technicians then must pay in order to gain access to these, and related, data.

One other aspect of the coordination role deserves some attention here. With the development of automated information retrieval and collection technologies and the increasing global awareness of the importance of scientific information, there have been strong indications of desires both by UNESCO and OECD for an international science information collaborative effort through a network of systems. The NSF has been given the responsibility as lead agency for coordinating and developing U. S. policy by the Department of State toward such a cooperative stance, and has actively sought to provide support allowing suitable representation from the U. S. scientific community and information users. But the issues surrounding such evolving international science information systems also favor an integrated and coordinated posture within the Federal Government. The NSF, as one agency among equals, can realistically expect some difficulty in ensuring implementation of its recommendations to Governmental or private sector operating systems, which may be interested in expanding their roles without the constraints imposed by the apparatus developed by the NSF or any international affiliation.

As a successor body to the Science Information Council (which NSF allowed to expire under the conditions of the Federal Advisory Committee Act), the Foundation is currently considering the appointment of a new advisory committee or panel. There has been some indication that this group also may be called upon to fulfill some coordinating role beyond its basic advisory function. However, unless it is specifically

chartered to do so, there is serious doubt whether such a group would be allowed to exercise any coordinating authority beyond information exchange.

Research and Development. The Office of Science Information Service (OSIS), presently headed by Dr. Lee G. Burchinal, was specifically authorized by the National Defense Education Act of 1958 (Title IX) to provide, or arrange for the provision of, science information services and to develop improved information methods. OSIS has acknowledged a change in priorities, beginning in fiscal year 1973, aimed particularly toward a redirection of its coordinating responsibilities, discussed above, and its research and development programs. These programs fall within the second functional category in our analysis -- the role of R & D in science information technology.

In previous years, OSIS-supported research was focused on improving access to the literature of various scientific disciplines. The shift of focus is noted in the 1973 NSF Annual Report:

> Planning was initiated to expand information services to users in technological fields and to study the economics of information transfer. Support for improvements in information systems, a previous emphasis, continues, but with priority given to retrieval of quantitative data and development of compatibility and interconnections among Federal and private bibliographic retrieval systems. An expanded research program remains the basis of all OSIS activities. 15/

In his address to the Annual Meeting of the American Society for Information Science in October 1974, Dr. Burchinal gave further indication of the new research priorities in his office:

> No longer will major support be provided for establishing, maintaining, or expanding specific information services. OSIS funds, instead are being used to produce generalizable results that can help

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15/ NSF Annual Report, 1973. p. 60.

improve methods of acquiring, transmitting, retrieving, and using information in any scientific or technical area. 16/

This shift in research priorities, from support of existing systems to generalizable results, represents an important step in the evolution of improved science information systems responsive to national goals. However, it is uncertain whether such a step should be taken at the expense of the support of the small private sector activities, especially those operated by the professional societies, which may face extinction as a result. In the face of increasing budget constraints, OSIS could not continue to provide consistent -- even minimal -- support and attention to both areas.

Other responsibilities in the research role of NSF include the evaluation of other agency-sponsored and independently-funded R & D as related to STINFO management and support. There is some indication, historically, that Federal agencies have relied extensively on retrieval techniques developed by industry -- if so, then NSF should perhaps assume the responsibility both for evaluating the technological innovations developed outside Government and making the results of industry R & D accessible to potential users within the Federal Government. An inspection of the program priorities of NSF reveals indications that in a search for more visible results, these "amorphous" or long-term research "linking pin" endeavors are often neglected or downgraded.

As part of its redirection in the area of coordinating responsibilities, the Office of Science Information Service has funded several studies

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16/ Burchinal, Lee G. "Toward National Coordination of Scientific and Technical Information Through Research and Development". Presented in October 15, 1974. p. 4. The entire address is included as Appendix E.

which if substantially expanded may develop a broad overview of existing information systems. These include: 17/

--Project by the American Society for Information Science (ASIS) to investigate the planning requirements of the OSIS science information research program, but does not look at existing information systems ($132,300);

--Project by The George Washington University to study planning and development programs for the "committee on scientific and technical information" ($36,000);

--Project by the firm of Braddock, Dunn and McDonald, Inc., which surveys "U.S. government science and technology information services purchasing practices" ($72,400).

But without specific authority, OSIS can do little more to implement the fundings of coordination improvement studies other than make their results available to the managers of Federal operating systems.

Legal and Executive Authorities

Our second approach in describing the roles which NSF exercises in the management of scientific and technical information is an examination of the legal authorities upon which NSF bases its STINFO activities. These authorities include legislation and executive orders, as well as letters between the President and the Director of NSF. In later years, these authorities have also included more informal agreements between the President's Science Adviser and the NSF Director.

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17/ Information provided by OSIS, NSF.

1950-1970: Early Responsibilities. In 1965, a report prepared for FCST 18/ published a listing of all "known legislative and executive authorities affecting the responsibilities of NSF for technical information services". This listing included five specific authorities:

1. The National Science Foundation Act of 1950, Public Law 81-507;

2. The National Defense Education Act of 1958, Title IX, Public Law 85-864;

3. Letter from President Eisenhower to the Director of NSF (Dr. Waterman), dated January 1959;

4. Executive Order 10807, "Federal Council for Science and Technology", March 13, 1959; and

5. The Agricultural Trade Development and Assistance Act, Public Law 83-480, as amended by Public Law 85-477 and as interpreted by Executive Order 10900, January 6, 1961.

These five documents and their amendments established the legal framework within which NSF developed its early operations in scientific and technical information.

The baseline for NSF STINFO activity was formed by the original National Science Foundation Act of 1950, which authorized and directed the Foundation to "foster the interchange of scientific information among scientists in the United States and foreign countries". Section 11 in this Act also states that the Foundation shall have the authority "to publish

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18/ U.S. Federal Council for Science and Technology. Committee on Scientific and Technical Information. Recommendations for national document handling systems in science and technology. Appendix A -- A background study -- Volume II. NTIS PB 168 267. pp. 9-22 through 9-26.

or arrange for the publication of scientific and technical information so as to further the full dissemination of information of scientific value consistent with the national interest".

Under Title IX (Sections 901 and 902) of the National Defense Education Act of 1958, the Foundation was directed to establish a Science Information Service (SIS) and a Science Information Council, which would serve as an advisory group. The Act stipulated that the Science Information Service would:

> (1) provide, or arrange for the provisions of indexing, abstracting, translating and other services leading to a more effective dissemination of scientific information, and
>
> (2) undertake programs to develop improved methods, including mechanized systems, for making scientific information available.

The Science Information Service was established by the Foundation in December, 1958, and the appointments to the Science Information Council were completed by the end of that month.

In January 1959, President Eisenhower directed the Foundation Director by letter to implement the recommendations developed by the President's Science Advisory Committee. These recommendations focused on effective coordination of scientific information within the Federal Government, and were included in a report submitted to the President, known as the "Baker report" (see Appendix C). The Federal Council for Science and Technology was created by Executive Order 10807 in March of 1959, and this order also directed the Foundation to provide "leadership in the effective coordination of the scientific information activities of the Federal Government with a view to improving the availability and dissemination of scientific information". As noted in the FCST report, "Federal

agencies were directed to cooperate with and assist the Foundation in performance of this function". 19/

To help carry out its assigned responsibility for coordinating scientific information services within the Federal Government, NSF established a Federal Advisory Committee on Scientific Information. But this committee's activities decreased in 1960, and in May 1962 the FACSI coordinating and planning functions were assumed by the new Committee on Science Information (COSI) established by the Federal Council. 20/

NSF also was given authority to conduct activities and research in collecting and translating scientific and technical information developed overseas by P.L. 83-480, as amended. Responsibilities under this authority were delegated to the NSF in Executive Order 10900 in January 1961.

In 1962, the President submitted Reorganization Plan No. 2 to the Congress, which created the Office of Science and Technology (OST). This transfer of science advisory, policymaking and coordination functions from the Foundation to the new OST significantly altered NSF's role in science information. The review of NSF prepared in 1966 indicated that this transfer included.

> those functions relating to the coordination of Federal policies for the promotion of basic research and education in the sciences,

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19/ Ibid., p. 9-24.

20/ U.S. Congress. House. Committee on Science and Astronautics. Subcommittee on Science, Research and Development. The National Science Foundation -- a general review of its first 15 years. A report prepared for the committee by the Science Policy Research Division, Legislative Reference Service, Library of Congress. January 24, 1966. 89th Congress, 2d session. Washington: U.S. Govt. Print. Off., House Rept. No. 1219. p. 183.

and those relating to the evaluation of scientific research programs undertaken by agencies of the Federal Government. Although not specifically mentioned in the Reorganization Plan, the coordination of information activities within the Federal Government was an integral part of the broad area of coordination of Federal scientific activity for which the Office of Science and Technology assumed responsibility. 21/

New Frameworks Emerge. NSF received new authority in 1971 in the science information area through a less formal arrangement. Although the Federal Council and its subcommittee COSATI (the successor to COSI) had developed leadership in the area of Federal coordination and policymaking for inter-agency science information activities, the overall staff support from within OST had decreased. One study notes:

> In its budget request for FY 1967, OST had urgently requested an additional staff person to augment COSATI's effort, 'spearheaded directly by OST', to develop a national network of scientific and technical information systems, while continuing to develop effective information subsystems in the various agencies. This position was not approved. COSATI Chairman Knox [note: now Director of NTIS] left the commitee on November 30, 1966 to return to private industry. 22/

In 1971, the President's Science Adviser and Director of OST (Dr. David) reached an agreement with the Director of NSF (Dr. McElroy) that the NSF Office of Science Information Service would assume administrative responsibility and would provide chairmanship and supporting staff for COSATI. 23/ Their agreement transferred responsibilities

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21/ Ibid., p. 179.

22/ U.S. Congress. House. Committee on Government Operations. Subcommittee on Military Operations. The Office of Science and Technology. A report prepared for the committee by the Science Policy Research Division, Legislative Reference Service, Library of Congress. March 1967. 90th Congress, 1st session. Washington: U.S. Govt. Print. Off., p. 129.

23/ "Making technical information more useful". A report for the Chairman of the Federal Council for Science and Technology. June 1972. p. 40. See also NSF Annual Report, 1972. pp. 51-52.

to NSF which paralleled the non-Federal, academic and industrial coordinating activities developed by OSIS in the interim period of OST and COSATI's existence. The NSF 1972 annual report further noted that "as a corollary to the COSATI assignment, OSIS undertook to serve as the U.S. focal point in international science information relationships". 24/

In 1973, the complete dismantling of the Office of Science and Technology was included in the Reorganization Plan No. 1 submitted by the President to the Congress. The functions and responsibilities of OST, the President's Science Adviser and the President's Science Advisory Committee in the area of civilian science and technology planning were all transferred to the Director of NSF. As in the earlier 1962 reorganization plan which had created OST, science information policy planning and coordination were not mentioned as a particular responsibility in the transfer, but were integrally connected with the functions of planning for scientific research and education policy.

The President's Science Adviser had served as a focal point and channel for decisionmaking in the policy process affecting all areas of science, and several reports questioned whether the Director of NSF could maintain effectiveness as a science adviser along with his administrative responsibilities. The elimination of OST and the disruption in the staff support for the Federal Council coordination and policy planning activities in the area of science information form a new framework for studying NSF's responsibilities in this area. As Science Adviser, Dr. Stever has inherited the responsibility for guiding STINFO activities, but there is scant public

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24/ NSF Annual Report, 1972. p. 51-52.

record of continuous initiative in this area. It is only with the dilution of higher level groups that the Foundation is called upon to play the coordination and policymaking roles for science information. NSF has traditionally supported its research and development role, and without a clearly defined responsibility the Foundation has not shown much enthusiasm for pursuing the latter two roles.

In 1960, when the Foundation first began its attempts to coordinate Federal scientific information activities (information processing and retrieval programs), early dissatisfaction was reported in a study prepared by the staff of the Senate Committee on Government Operations. The report, published in June 1960, said "repeated statements" had been made

> that there was a serious lack of coordination and direction by the National Science Foundation on whom reliance has been placed for leadership in all civilian science fields. These allegations have been based upon the practice of the NSF to support the development of uncoordinated projects of particular agencies or segments of industry without a proper determination having been made as to our national requirements, or the initiation of a coordinated study and evaluation of the systems that would be needed to meet these requirements...
>
> Deficiencies which may exist in the programs of the NSF (i.e., lack of coordination of Federal and nongovernmental activities) are probably due to the large limitations placed upon its activities by statutes which do not permit it to exercise operating functions. 25/

The staff report further noted the comments of NSF Director Waterman. His response indicated that the NSF "is not statutorily barred" from operating science information systems, but preferred to work through indirect support mechanisms:

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25/ U.S. Congress. Senate. Committee on Government Operations. Documentation, Indexing, and Retrieval of Scientific Information. Staff study. 86th Congress, 2d sess. Washington: U.S. Govt. Print. Off., 1960. Senate Document No. 113. pp. 24-25.

...more can be gained by close cooperation with, and in support of, existing scientific information services in the United States, both public and private, where they are functioning effectively, than by direct Federal operation of such services. The scientific information services rendered by many of the scientific societies and professional institutions to the scientific community are world famous for their quality. We believe it is essential that the Federal Government continue to cooperate with, and assist, such private groups in the achievement of long-range solutions to scientific information problems. 26 /

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26 / Ibid., p. 25

## III. FEDERAL STINFO MANAGEMENT AND SUPPORT

In looking at the evolution and refinement of scientific and technical information services over the past 15 years, certain specific achievements reflect the direct support of the National Science Foundation:

1. Establishment of 21 self-supporting primary scientific journals.
2. Computerization of 7 major professional society-based abstracting-indexing services.
3. Support of academic research, specifically, development of Information Science as an academic discipline.
4. Development of 6 university-based science information systems.
5. Stimulation of a strong, viable for-profit science information industry.

It should be noted that many of these information systems have reached the point where Federal funding no longer is made available.

Turning the calendar back to fiscal year 1960, shortly after the Sputnik shock, an examination of Federal Government scientific and technical information obligations reveals a total of $75.9 million for selected extramural and all intramural STINFO activities. Other extramural STINFO data, for such activities as those performed under a contract or grant primarily for R & D or scientific education and training are excluded from the official NSF survey, and probably would exceed $100 million for FY 1962. 27/ In those early years, STINFO obligations contained in the NSF survey were estimated at approximately 1% of Federal obligations

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27/ U.S. National Science Foundation. Federal funds for science X. Fiscal years 1960, 1961, and 1962. Surveys of science resources series. NSF 61-82. p. 44.

for research and development. Inclusion of the extramural (non-survey) activities would boost the ratio to approximately 2%.

As shown in Figure 1 in the Introduction, there has been a continuing trend over the past 15 years to support more strongly scientific and technical information activities through Federal obligated funds. A six-fold increase may be noted -- from $75.9 million in FY 1960 to $440.2 million (estimated) 28/ in FY 1974 -- with the chief increase for "documentation, reference, and information services" accounting for 46% of the funding as compared with 37% in 1960. In actuality, expressed in dollar growth, the increase has been sevenfold during this period. Obligations for "publication and distribution" have dropped from 49% to 29%, although there has been a substantial dollar growth. Key data on these categories and those identified as "symposia and audiovisual media" and "R & D in information sciences, documentation and information systems, techniques, and devices" are shown in Figure 2. 29/

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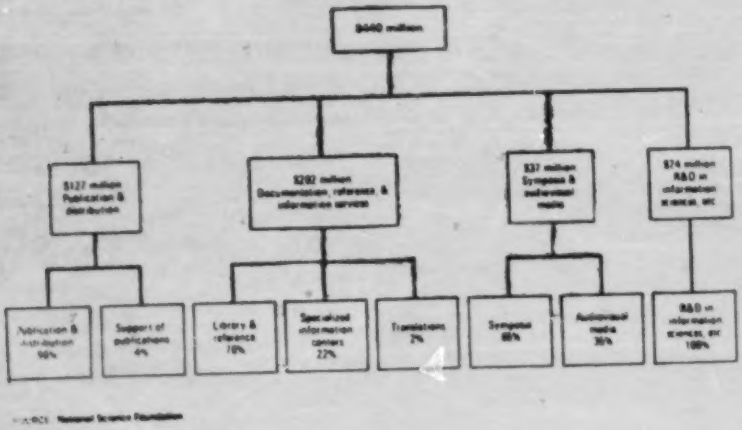
28/ U.S. National Science Foundation. Federal funds for research, development, and other scientific activities. --Fiscal years 1972, 1973, and 1974. Surveys of science resources series. NSF 74-300, vol. XXII. p. 38.

29/ Ibid., p. 39. It should be noted that differences in definition for the activities and categories being reported account for varying funding estimates. One such report, issued in 1972, indicates obligations more than double that shown in the NSF document noted above.

FIGURE 2

Federal obligations for scientific and [illegible] FY 1974 (est.)



By 1974, STINFO obligations were slated to be equal to 2 1/2% of total Federal R & D obligations.

It is important to note, and of critical national concern in an age of great Governmental and societal requirements for valid, up-to-date scientific and technical information, that the management apparatus within the Federal Government appears to be less sturdy and less dedicated to sustained oversight than a decade ago. Policymaking elements such as the Federal Council for Science and Technology, traditionally the Governmental mechanism with the most senior, involved representation, has evinced only minimal interest in controlling duplication of effort in R & D projects or supporting those information products and services which could

eliminate or at least minimize such overlap. Not only are Federal agency STINFO programs often inadequately supported, but this inattention to a national resource extends to the hard-to-nurture services offered by the leading American scientific and engineering societies. New user needs, emerging from the increasingly interdisciplinary nature of research activities, also were only sporadically recognized as a force affecting future information services. Disappointment over the inaction of the FCST Committee on Domestic Technology Transfer, the only existing interagency element with responsibilities toward the STINFO arena, has been registered in many quarters. It would appear that few agencies have made use of STINFO in their technology transfer or technology utilization programs.

For ten years, the Office of Science and Technology, created in 1962, served as a focal point of oversight and active coordination of STINFO activities. With the Committee on Scientific and Technical Information serving as a working secretariat and conceptual center, the Federal community had a visible, prestigous point of reference. It would be found, however, that more was needed in the way of high-level involvement than simply creating and maintaining a "watchdog" group.

The difficulty of having an organization such as NSF, through its Office of Science Information Service, exert any meaningful influence on peer establishments was noticeable soon after that group's creation. The impact of COSATI as an OST functionary looked more promising, on the other hand, but after repeated failures to delegate certain types of authority, fund staff expansion, and follow through on such milestone studies as the System Development Corporation "Recommendations for National Document Handling Systems in Science and Technology" (in 1965), it

became apparent that the STINFO priority was not very high. This type of non-support diminished the great expectations which had burgeoned as the result of the Crawford Report (1962), which had led to the transfer of responsibilitities from the NSF Federal Advisory Committee on Scientific Information to the newly created Committee on Scientific Information (later COSATI) and recognition of the responsibilities of departmental offices for directing and controlling information activities. Interagency concern and emphasis was placed on engineering, organizational, and management changes in the Federal information activities rather than improvement of specific systems. During this same period, concurrent developments saw the Bureau of the Budget establish a Science Division, Congress revamp its committee structure in order to better oversee science and technology -- meanwhile hoisting the national priority on science education -- and support the creation of a new scientific research capability within the Library of Congress.

Early in 1963, the President's Science Advisory Committee was presented with its commissoned study, popularly known as the Weinberg Report, on "Science, Government and Information." The crux of this blue-ribbon panel's findings was that the transfer of information is an inseparable part of research and development. In essence, the STINFO activity is of value to a researcher before, during, and after his project. The recommendation reads:30/

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30/ U.S. President's Science Advisory Committee. Science, government, and information. The responsibilities of the technical community and the government in the transfer of information. A report of the President's Science Advisory Committee. January 10, 1963. p. 4-6.

> ...each Federal agency concerned with science and technology must accept its responsibility for information activities in relevant fields, and must devote an appreciable fraction of its talent and other resources to support of information activities.

Supporting recommendations included two relating to White House involvement:

> ...the entire network of Government information systems should be kept under surveillance by the Federal Council for Science and Technology.
>
> ...problems of science information should be given continued attention by the President's Science Advisory Committee.

Although the panel report presented nearly 200 specific recommendations, it was less a national plan for handling information than a set of principles upon which action might be based. One noteworthy suggestion: the specialized information center concept, later endorsed by COSATI, eventually resulted in the development of some 120 Federally-supported information analysis centers.

During the 1959-1966 period, there was considerable activity concerning scientific and technical information handling within the executive branch and the Congress; for the latter, see Section IV. In addition to the series of reports (Baker, Crawford, Weinberg) whose recommendations were often less than optimally carried out, the Federal Council for Science and Technology did authorize a National Standard Reference Data System under the aegis of the National Bureau of Standards (1963) and approved a new charter for the Committee on Scientific and Technical Information (COSATI), to replace COSI, the following year. The "watershed" in FCST encouragement and support, in many observers' opinions, came in 1965 with the inaction accorded the COSATI task force report (prepared with the assistance of the System Development Corporation) dealing with national document handling systems. Another indication of retrenchment

was the refusal to the Office of Science and Technology for a staff person to coordinate a network of STINFO systems. It should not be inferred that there were few positive actions during these years, however. At the departmental and agency level, the early direction and encouragement led to significant steps being taken by several executive branch elements:

- o The Department of Commerce, abetted by COSATI, expanded its Office of Technical Services, renamed the Clearinghouse for Federal Scientific and Technical Information (CFSTI). This organization is now called the National Technical Information Service.
- o The Smithsonian Institution, supported by NSF and COSATI, brought into being the Science Information Exchange -- replacing earlier services in the bio-sciences information area -- which now operates as the Smithsonian Science Information Exchange (SSIE), a nonprofit organization affiliated with the Smithsonian Institution.
- o The Department of Defense, responsible for vast amounts of S&T information, used its existing Armed Services Technical Information Agency (ASTIA) as the base for creating the present Defense Documentation Center. Also, the position of Director of Defense Technical Information was established, affording senior staff cognizance of a priority activity. It should be noted that the position and the function were eliminated a few years ago.
- o The National Science Foundation, as has been indicated, played a key role by aiding other agencies, working with the COSATI staff, and initiating a supplement on STINFO activity as part of its reports on Federal Funds for R & D.

And so, through actions undertaken by the executive branch, a variety of STINFO services evolved. Some took the form of agency-focused information services (such as DDC), while others purposefully assumed a "national" service posture (e.g., NTIS, SSIE). In all of this buttressing of the STINFO function, with higher level recognition and funding requests, there still existed a problem on the part of many managers concerning the importance of "information" and whether or not it should be treated only as a subset of each activity area. This orientation process is still in flux, although in general there is a better understanding of the concept that information is a commodity, a tangible, which must be dealt with in a special way.

The key mechanism in the "world of STINFO" for a number of years was the Committee on Scientific and Technical Information, widely referred to as "COSATI". In the first years of its establishment, members were urged to keep in perspective the collective goals of COSATI and not stress to excess the promotion of their own programs. Reorganized by 1966, emphasis was placed on the development of national systems. The chairman at that time, William T. Knox, used the "panel" approach in undertaking work in key areas; panels were created on:

- o Management of Information Systems
- o Information Science Technology
- o International Information Systems
- o Operational Techniques and Systems
- o Education and Training

Perhaps most active was the COSATI National Systems Task Group, which sponsored four major studies:

1. Study of scientific and technical data activities within the United States (by Science Communication, Inc.);
2. Study of abstracting and indexing (by System Development Corporation);
3. Study of oral and informal communications (by American Institute for Research); and
4. Study of national document handling systems, noted above (by System Development Corporation).

As implied earlier, many of the recommendations from these investigations were not acted upon positively or negatively. Representation from the Federal community gradually widened, with observers from such diverse groups as the U.S. Postal Service, Central Intelligence Agency, Library of Congress, and Social Security Administration in attendance. In other words, COSATI began to evolve into a body that brought together the Federal R & D community and other governmental groups concerned with the use of STINFO or building information services to enhance the accomplishment of their mission. Appendix H depicts the breadth of the STINFO community in 1965. 31/ The COSATI presence, in itself a motivating factor designed to prompt action and connote a priority attention by top government circles, was manifested in many ways. Quite early, COSATI was instrumental in implementing the "page charge" policy previously approved by the FCST, modifying the microfiche standard in the interest of broader utility, developing a standard for descriptive cataloguing and

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31/ U.S. Federal Council for Science and Technology, Committee on Scientific and Technical Information. Recommendations for national document handling systems in science and technology, op. cit., p. 6-5.

a subject category list, and working to raise Civil Service professional guidelines and ratings for STINFO professional personnel. Although possessing limited clout, COSATI by virtue of its acknowledged role and leadership, did much to formulate an approach to coordinating STINFO services and planning.

Late in 1965, a Committee on Scientific and Technical Communication (SATCOM) was established by the National Academy of Science and the National Academy of Engineering in response to a request by the National Science Foundation and the Office of Science and Technology (via COSATI). Through NSF's funding, SATCOM prepared to investigate the present status and future requirements of the S&T communities with respect to the flow and transfer of information. The ensuing report set forth 55 recommendations, many pertaining to the Government, which were considered essential to the effective communication of scientific and technical information. Not publicly released until 1969, the report contained a primary recommendation for the establishment of a Joint Commission on Scientific and Technical Communications, responsible to the Councils of the National Academy of Science and the National Academy of Engineering and various coordinating commissions. (See Appendix C.) In essence, the Committee's recommendations reflected a firm conviction that generators and users of S&T information must assume increasing responsibility for the more effective transfer of such information.

The difficulty during these latter years of the 1960 decade was not in coming up with innovative, workable schemes and procedural changes which could enhance STINFO usefulness, but in getting effective support. The COSATI staff, under the chairmanship of Andrew A. Aines, worked assiduously not only to maintain a posture of cooperation and looking to

the future, but sought (unsuccessfully) through its parent Office of Science and Technology to have sufficient staff resources to carry out earlier mandates. One example of COSATI effectiveness was a cooperative endeavor with the Library of Congress MARC (Machine-Readable Cataloging) task force to define a magnetic tape format for technical reports. COSATI was active in bringing about the establishment of the National Advisory Committee on Libraries; subsequently Congress enacted legislation creating the National Commission on Libraries and Information Science (NCLIS). International exchange of information was fostered through a COSATI panel, which also supported the United States' delegation to UNISIST (World Science Information System). By these, and other actions, COSATI was a moving force, but hampered by the lack of top level support, "barebones" funding and staffing, and a charter which forced reliance on cajolery to obtain cooperation from executive branch elements rather than having the power to ensure strong involvement and commitment of resources.

The restrictions on a group such as COSATI, resulting in frustration both within that group and on the part of those served, had been signalled as early as 1960 by Senator Hubert H. Humphrey when he commented that:[32/]

> Those who place their reliance on coordinating devices such as interagency committees for improving communications and for providing stimulus to Government science activities fail to recognize the built-in limitations of these approaches. By their very nature interagency committees cannot be creative except at a very low level of

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32/ U.S. Congress. Senate. Committee on Government Operations. Documentation, indexing, and retrieval of scientific information. A study of federal and non-federal science information processing and retrieval programs. 86th Congress, 2nd session. Washington, D.C., U.S. Govt. Print. Off., 1960, Document No. 113. p. 6 [quoting Senator Hubert H. Humphrey]

> operation. They are inevitably restricted by the view of the most pedestrian and unimaginative members. Their product will almost certainly be a kind of lowest common denominator of their combined ideas.

He then proceeded to underscore what years in the Washington political environment had taught him about the criticality of "location" of a governmental mechanism, and the power which results from being "close to the throne:"33/

> What is needed is dynamic, forceful, and continuing leadership which could best come from a cabinet department with clear-cut responsibility and authority in the field of science and technology. [italics added]

A significant event occurred early in 1971 with the transfer of COSATI from the Office of Science and Technology -- which would be abolished two years later -- to the National Science Foundation. It should be understood that during 1971, COSATI continued to serve the FCST as the agent for "the review and coordination of the activities of the Federal executive departments and agencies, through providing a forum for the exploration of policy issues, and a mechanism for interaction with the private secor." 34/ Under its new chairman, Melvin S. Day, COSATI responded to a request from the FCST chairman to initiate a "program review." A seven-man Review Group led by Dr. Martin Greenberger

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33/ Ibid.

34/ U.S. Federal Council for Science and Technology. Committee on Scientific and Technical Information. Progress in scientific and technical communications. COSATI annual report in 1971. COSATI 72-2. Washington, D.C., National Technical Information Service, 1972. p. 3.

of The Johns Hopkins University was charged with examining the Federal government's role in: 35/

- o formulating national technical information policy
- o the management and coordination of Federal technical information activities
- o the utilization of the capabilities of the private section

Completed in June of 1972, the Greenberger Report pointed up both the strengths and shortcomings of present Federal government handling of technical information activities. (See Appendix C.) After stressing that the Nation needs to capitalize upon its valuable technical information resources in policy planning, operating the country's S&T enterprises, and designing major social programs (with increasing technological content), the authors identified factors which had prevented the government from achieving its aims in such areas of responsibility (see above) as policy planning. In particular, lack of success was attributed to: 36/

- o daily concerns overshadowing the need for forward-looking policies
- o Federal agencies often being unwilling to defer their own immediate interests for common purposes
- o neglect of technical information problems that cut across organizational boundaries
- o insufficient attention to the user.

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35/ U.S. National Science Foundation. Making technical information more useful. The management of a vital national resource. A report for the Chairman of the Federal Council for Science and Technology submitted via the Director of the National Science Foundation. June 1972. p. 3.

36/ Ibid.

Citing the need, unanimously arrived at, for a "major redirection" of technical information activities, the Review Group underscored the importance of focusing upon the needs of the user of information programs and the fact that investments in information programs must be related to the value derived by those users. Two new organizational entities were recommended in this report, aptly named "Making Technical Information More Useful": first, an Information Policy Board comprised of public and private sector representatives, supported by a strong, resident staff. Secondly, a Federal Technical Information Committee consisting of agency representatives responsible for coordinating governmental technical information activities and developing standards and systems capability. These new groups would supersede SIC and COSATI, both of which subsequently have expired. This report, which remains unpublished after more than two years, not only contains a useful exposition of many specific problems -- e.g., ineffective information packaging and repackaging, cost effectiveness of information, inadequate standardization -- but sets forth viable alternatives for corrective action.

The Committee on Scientific and Technical Information has ceased to exist. The NSF Office of Science Information Service does sponsor, from time to time, gatherings of Federal information managers to exchange ideas and information on current products and services. The Science Information Council went out of existence December 31, 1974, but did formally recommend at its final meeting that the NSF leadership establish a "Science Information Advisory Committee" to fulfill traditional SIC functions and to respond to current STINFO community needs.

In retrospect, the efforts put forth over approximately the last 15 years have resulted in a perceptible improvement in scientific and technical

information collection, processing, and dissemination to would-be users. With that growth in activity and coverage have come, not surprisingly, problems of coordination, funding, establishment of priorities within participating agencies, and simply "moving with the times". The urgency felt in the period immediately after the first Sputnik episode may have lessened in the minds of many key officials, but a closer inspection of national needs reveals a broader spectrum of requirements for selected, current scientific and technical information. The results of R & D undertakings, in an age with severe energy and environmental dilemmas, must be available through distribution to cognizant STINFO users and the public at large (on a regular basis) in a variety of forms. It is difficult to understate the central role which information plays in technology transfer and the significant, if often subtle, increase in how people use science and technology in their daily lives. A consensus has developed throughout Government over the years that planners, program managers, research specialists, and those who approve the fiscal underpinning... all must be aware of the resources and potential of STINFO holdings and services. And finally, at a time when international considerations were never more imperative, national policies governing the exchange of such information must be reexamined and assigned to responsible Federal Government organizations.

## IV. CONGRESSIONAL ACTIVITIES RELATED TO STINFO

Congressional involvement in the management and funding of scientific and technical information activities has been fragmented throughout both Houses of Congress for the past fifteen years. The wide-ranging effects of scientific information are reflected by the different approaches taken by individual Members and committees who have offered proposals relating to the management of this resource. Three major committees and one select committee in the House, and one major committee in the Senate have separately addressed the issues evolving from the management and funding of scientific information. They are:

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|---|---|
| 1958-1963 | Senate Government Operations, subcommittee chaired by Senator Hubert H. Humphrey |
| 1958-1961 | House Government Operations, Rep. John W. McCormack presiding subcommittee chairman |
| 1963-1964 | House Education and Labor, ad hoc subcommittee chaired by Rep. Roman C. Pucinski |
| 1964-1965 | House Select Committee on Government Research, chaired by Rep. Carl Elliott |
| 1966-1969 | House Science and Astronautics, subcommittee chaired by Rep. Emilio Q. Daddario |
| 1969 | House Education and Labor, subcommittee chaired by Rep. Roman C. Pucinski |

Other subcommittees, such as the House Subcommittee on Research and Technical Programs chaired by Rep. Henry S. Reuss during the mid-sixties and the Senate Subcommittee on Government Research chaired by Senator Fred R. Harris during the later part of that decade, have addressed issues related to the management of scientific information. However, their focus lay with such problems as "the brain drain", Federal foreign research and social science research spending, and the compilation

of inventories of congressional concern with R & D. Therefore, it was not appropriate to include their records in this analysis. Since 1969, there have been no hearings in either House on the subject of scientific and technical information handling.

STINFO activities and importance early gained attention from congressional leaders in the wake of Sputnik. In October 1957, the successful orbiting of the Russian satellite ignited an intense investigation into the weaknesses of the U.S. scientific program with scientific information handling being singled out as one key area in which the Americans had much to learn from the Russians. In his State of the Union address in January 1958, President Eisenhower emphasized the importance of the exchange of "appropriate scientific and technical information with friendly countries", and the Senate Committee on Government Operations shortly thereafter held a series of hearings exploring the cluster of problems within the environment related to scientific research in the United States. Several witnesses enviously described the Soviet All-Union Institute of Scientific and Technical Information (VINITI), in which a trained permanent staff of 2,000 (supported by 20,000 abstracters) produced some 360,000 scientific abstracts in 1956 and indexed 8,000 scientific journals annually. 37/ These witnesses also discussed with some candor their frustrations in creating an awareness within our government of the value of such an information handling capability. Their statement reflecting this official inattention is simply summed up: "we have talked to deaf

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37/ U.S. Congress. Senate. Committee on Government Operations. Science and technology act of 1958. Analysis and summary prepared by the staff. 85th Congress, 2d session. Washington: U.S. Govt. Print. Off., 1958. Senate Doc. No. 90. p. 182.

ears". 38/ Dean Jesse Shera of Western Reserve University was one articulate advocate of the need for a "world scientific information exploitation plan" 39/ as a blueprint for U.S. STINFO developments. He proposed that a National Institute of Documentation, patterned after and capable of matching the accomplishments of the Soviet information center, be established within the Department of Science structure under consideration by the Humphrey subcommittee.

Other witnesses in these early hearings underscored the poor information systems available in the U.S. for on-going research, and the needless waste resulting from agencies duplicating research programs. An industrial spokesman stated that it was cheaper to do a $100,000 research job than to find out if it had been done before, 40/ and others lamented the timelag in such private publication indexes as Chemical Abstracts.

During the early months of 1958, the House Committee on Government Operations also explored the information handling problems surrounding U.S. research and development, particularly as compared to the recent relevant Soviet achievements. When confronted with the slowness inherent in our translation of foreign scientific publications, several Congressmen questioned why the U.S. could not make available research results as quickly as the Russians did. Rep. John W. McCormack (Mass.), at that time Majority Leader and later to become Speaker of the House,

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38/ Ibid., p. 181.

39/ Ibid.

40/ Ibid., p. 179.

asked NSF Director Alan T. Waterman to describe more specifically the scale of the scientific information problem:

> Rep. McCormack: Is it a fact that there has been a failure on the part of our Government and agencies to enter into this field of getting this scientific information and evaluating it and seeing that it was distributed in at least informed circles?
>
> Dr. Waterman: It is not a complete failure, because as I was just saying --
>
> Rep. McCormack: Is it a failure -- has it been a failure? I did not say 'complete'.
>
> Dr. Waterman: It has not been as successful as it should be.41/

One proposal designed to offset the Soviet scientific achievements by marshalling U.S. resources was S. 3126 in the 85th Congress, the Science and Technology Act of 1958, introduced by Senator Humphrey. This legislation would have created a Department of Science and Technology, with an important part of the proposed structure a set of functions relating to the collection, indexing and dissemination of scientific information. A special agreement was arranged between Senator Humphrey and Senator Lyndon B. Johnson, who at that time had been appointed to chair the Special Committee on Space and Astronautics (established in March 1958). The Humphrey subcommittee was permitted to develop certain aspects of the Department of Science proposal, particularly those relating to the establishment of a centralized scientific information center. Hearings were held on this topic in May and June of 1958, with the testimony comprising

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41/ U.S. Congress. House. Committee on Government Operations. Executive and Legislative Reorganization Subcommittee. Research and development. Hearings, 85th Congress, 2d session. January 15, 1958. Washington: U.S. Govt. Print. Off. 1958. p. 64.



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a useful record which documented much of the post-war U.S. efforts to manage scientific and technical information.

At the same time these hearings and supporting studies were underway, separate legislation was introduced in the Senate and referred to the Committee on Labor and Public Welfare. This bill, S. 3187, included a title proposing that there be established within the NSF a Science Information Service and a Science Information Council to provide for the more effective management, production, and dissemination of scientific information. Superseded by other legislation, this same title was included in the final passage of the National Defense Education Act in September, 1958 (P.L. 85-864). It is important to note that P.L. 85-864 is the most recent legislation on record that specifically authorizes the NSF to sponsor and encourage scientific information services. Although many bills have subsequently been introduced in both Houses which would reinforce or remove this authority, no other proposal has been enacted into law.

Although Senator Humphrey's proposals were much broader and envisioned a national scientific information center operated by Federal funds, his legislation was met with little enthusiasm by representatives of Federal agencies who testified during the hearings on the Science and Technology Act. The Government witnesses participating in the 1958 hearings generally agreed that no additional legislation authorization was needed to improve U.S. capabilities in managing scientific information. The NSF Director, Dr. Waterman, assured the subcommittee that the Foundation "was taking steps to assume national leadership in the scientific and technical information services carried on both within and outside of Government". But he also indicated his preference for avoiding any

involvement by the Foundation in the direct operation of information services:

> ...in assuming these responsibilities, the Foundation sees itself primarily as an information and coordinating center; it will not perform scientific information functions or conduct operations that can be or are being carried on by other Federal or by non-Federal organizations. 42/

As a result of express Presidential attention to these matters -- members of the Science Information Council were appointed in December 1958, and the Baker report was issued by PSAC in that same month, followed shortly thereafter by President Eisenhower's directive to Dr. Waterman described in Section II -- the congressional committees relaxed their vigilance and concern over the management of scientific information. In February 1959, the Baker report was submitted without comment into the hearings record of the House Science and Astronautics Committee, which at that time was reviewing testimony on missile development and space science.

But, following adjournment of the 1st session of the 86th Congress (1959), the staff of the Senate Committee on Government Operations was directed to undertake further study of the scientific information problem. This scrutiny evaluated the progress made since 1958 in regard to the development of Federally-operated national scientific information systems, and in particular surveyed agency actions taken to complement recommendations made during the earlier 1958 hearings. The committee issued a report of its staff findings in 1960, eventually published as a Senate

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42/ U.S. Congress. Senate. Committee on Government Operations. Subcommittee on Reorganization and International Organizations. Progress report on science programs of the Federal Government. 85th Congress, 2d session. September 9, 1958. Washington: U.S. Govt. Print. Off., 1958. S. Rpt. No. 2498. p. 17.

document, which expressed serious doubt as to whether the interagency committee (FACSI) established by NSF would provide the necessary services required in the documentation field. 43/

The committee then contracted for two "consultative analyses" to be prepared by Dr. Edward Wenk, Jr. of the Legislative Reference Service (Library of Congress) and Dr. Joshua Stern of the National Bureau of Standards. 44/ The Wenk study, published in 1961, included commentary by subcommittee chairman Senator Humphrey, and a statement of policy by the full committee based on the findings of the analysis. Humphrey's "Model T" statement soon became a cornerstone for further legislative proposals:

> Formal intra-agency information systems do exist, but they cover only a segment of basic and applied research and development. Some systems are simple, some elaborate; but in total, they tend to be a hodgepodge; they are overlapping, underplanned, undernourished, and underused.
>
> In effect, so far as data on current work is involved, the agencies use, with but few exceptions, 'Model T' methods in a jetage. But a 'Model T' will not suffice in an era of $8 billion Federal research and development support. 45/

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43/ U.S. Congress. Senate. Committee on Government Operations. Documentation, indexing, and retrieval of scientific information. Staff study. 86th Congress, 2d session. Washington, U.S. Govt. Print. Off., 1960. Senate Document No. 113. p. 6.

44/ ____. Subcommittee on Reorganization and International Organizations. Coordination of information on current scientific research and development supported by the United States Government. [Wenk study] 87th Congress, 1st session. May 18, 1961. Washington, U.S. Govt. Print. Off., 1961. Senate Report No. 263.

____. Coordination of information on current Federal research and development projects in the field of electronics. [Stern study] September 20, 1961. Washington, U.S. Govt. Print. Off., 1961.

45/ Wenk study, op. cit., p. 276.

These staff studies and consultative analyses highlighted a specific issue within the broad problem of STINFO management -- namely, the coordination of preparing, storing, processing, and disseminating information on current Federally supported research and development. Although the Science Information Exchange (SIE) was established prior to the publication of the Wenk study, Humphrey's introductory statement attributes the subcommittee's investigation into this area as a "catalytic agent" in the creation of SIE. It should be noted that SIE was established without a legislative mandate, and as the Wenk study noted, this service suffered from the problem of relying upon voluntary contributions of agency research and development narrative information and related statistics. This same weakness was more recently iterated in a 1972 GAO report to the Congress, which stated:

> Many Government agencies are not using the Science Information Exchange to the fullest extent because, they claim, its data bank is not current or complete. At the same time the ability of the Exchange to provide current information is being hampered because the agencies are not providing the Exchange with the information it must have to perform the function of an information clearinghouse.
>
> Government agencies are not required to submit complete information on their research and development programs to the Exchange. But the Exchange cannot be an effective tool for coordinating Federal research without up-to-date information. 46/

The Stern study also had highlighted the unwitting, needless duplication of effort resulting from the lack of current information on Federal R & D projects, particularly in the field of electronics. In some cases, the

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46/ U.S. General Accounting Office. Effectiveness of Smithsonian Science Information Exchange Hampered by Lack of Complete, Current Research Information. Report to the Congress. B-175102. March 1, 1972. p. 1.

report stated that this waste "may cost the taxpayer not less than $200 million per year". 47/

In 1963 and 1964, two committees in the House began new investigations into the problems surrounding STINFO activities. The House Education and Labor Committee set up an ad hoc subcommittee to study a proposal for establishing a National Research Data Processing and Information Retrieval Center. The subcommittee was chaired by Rep. Roman Pucinski, author of the proposal, and included Rep. John Brademas and Rep. Alphonzo Bell as ranking members from each party. The bill under consideration would amend Title IX of the National Defense Education Act, substituting for OSIS a Science Information Center to be located in Chicago (which was Rep. Pucinski's home district). These hearings included more statements about the threat of VINITI, the Russian information institute, and included the Crawford and Weinberg reports as appendices. The hearing record also contained a "progress report" of the ad hoc committee, which identified several key issues related to STINFO activities:

> Scientific and technical information is a national asset comparable in value to any natural resource such as oil, iron ore deposits, or gold. It is a natural challenge to recognize the importance of scientific information and treat its development and exploitation with the same authority and expended effort normally accorded other natural resources.
>
> The lack of a coordinating effort to marshall all resources available to cope with the problem of processing and disseminating

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47/ Stern study, op. cit., p. xvii.

scientific information impedes progress in science and technology and creates waste and duplication in research and development. 48/

Although the proposed national center was not established, several recommendations included in the progress report merit attention. These included a proposed increase in the budget of the Office of Science Information Service and the initiation of steps leading to the development of a coordinated national information system, "similar in scope to the Manhattan project".

The House also studied the problems of scientific information through the Select Committee on Government Research, chaired by Rep. Carl Elliott of Alabama. The Select Committee was created in September 1963 to investigate the various research programs within the Federal Government; by the time of the completion of its work in January 1965, it had submitted to the House an interim report and ten substantive studies. In the first study produced by this official group, the value of scientific information was underscored as being "axiomatic" to the research process. Unless a research investigator can have access to information on current research projects, the study noted, "the value of research is diminished, as are its chances of being applied". 49/

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48/ U.S. Congress. House. Committee on Education and Labor. Ad Hoc Subcommittee on a National Research Data Processing and Information Retrieval Center. National information center. Hearings, 88th Congress, 2d session. april 27, 28 and August 13, 1964. Part 4. Washington: U.S. Govt. Print. Off. 1964. p. 891.

49/ U.S. Congress. House. Select Committee on Government Research. Administration of research and development grants. Study Number I. 88th Congress. 2d session. July 31, 1964. Washington: U.S. Govt. Print. Off., 1964. p. 66.

This first study, "Administration of Research and Development Grants", analyzed the operation and policies of SIE. A later study, "Documentation and Dissemination of Research and Development Results", looked at the problems of transferring information of completed R & D.

One particular focus of this later study was the standards and categories developed by OSIS and COSATI for determining the real costs of scientific and technical information. Coincidentally, COSATI prepared its first survey of these costs at the same time the Elliott committee began studying this area. The staff study indicated the discrepancies between NSF cost estimates and other estimates of the real STINFO costs, and noted further that NSF hoped to use its survey estimates as a basis for "trying to determine proper budget allocations for information in relation to total research and development budgets" for other agencies. However, the NSF surveys indicated that STINFO costs accounted in some cases for only one percent of the R & D budget. The committee study then compared this figure with the following statement:

> The present chief of the Science and Technology Division of the Library of Congress [note: Dwight E. Gray] wrote in 1962 that such a figure was inadequate; ten percent, he believed, would be more appropriate. 50/

The conclusions and recommendations contained in this fourth select committee study offer a good framework -- though dated -- for examining the problems surrounding STINFO management today:

> Scientific and technical information is the life blood of science ... There may be more information being generated than can be effectively handled; there may be more arteries than are needed to

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50 / ____. Documentation and dissemination of research and development results. Study Number IV. 88th Congress, 2d session. November 20, 1964. Washington: U.S. Govt. Print. Off. 1964. p. 13.

carry it. The greater the quantity of new research information, and the more widely it is dispersed, the harder it is for anyone to find what he is seeking....

The present situation, the select committee has found, is one that invites waste and inefficiency. There is no certainty yet that there is a great deal of either. It is only fair to point out that the pressures on those who administer the Government's research and development programs have been great and have left them little time. There is a tenacious clinging to prerogatives at any cost. 51/

The select committee noted also that there was some evidence of "stocktaking", as STINFO activities had finally emerged as a separate line item in the budgets of major R & D agencies. It should be noted, however, that more recently the NSF has ceased to include its OSIS program activity as a separate item. Instead, it has been incorporated into the special program category "National and Special Research".

The House Committee on Science and Astronautics, through its subcommittee directed by Rep. Emilio Q. Daddario, also touched on the problems of managing and funding scientific information during its hearings on national science policy in 1965 and 1966. The major studies regarding NSF, prepared for the subcommittee during this time, described in detail the executive and legislative branch activities related to STINFO. However, the committee pursued the more specific idea of a National Standard Reference Data System during hearings held in 1966. A bill was introduced by Chairman George P. Miller of the full committee in July of that year which dealt with one aspect of the broad science information problem by proposing a system to produce and disseminate compilations of critically evaluated quantitative data on the physical and chemical properties of materials. During 1967, the Daddario subcommittee monitored the progress of the SATCOM study prepared by the

51/ Ibid., p. 89.

National Academy of Sciences, and had two meetings with Smithsonian Institution personnel concerning a proposal for a series of conferences on future handling of scientific information.

The last major congressional hearings on the issue of scientific information were held in 1969 by the House Committee on Education and Labor, Subcommittee on Education (chaired by Rep. Pucinski). The topic of the hearings was a bill introduced by Rep. Pucinski to amend Title IX of the NDEA to provide for establishment of a national science research data processing and information retrieval system. During the testimony of Dr. Burton Adkinson, head of OSIS, Rep. Pucinski noted the changes in his thinking on mechanisms for disseminating scientific information since his earlier investigation:

> ... in 1963 we were talking about a center. We have learned a great deal since those early hearings, particularly that we are really talking about a system, not a center, because it is inadvisable to think of putting all of this information under one roof. 52/

Later on in these hearings, Rep. Pucinski directed harsh criticism toward the operations of OSIS, particularly regarding the need for a national system of scientific information:

> I have some serious doubt now whether the Science Information Service is capable of taking on these jobs. A national scientific and technical information system is such a vast undertaking that I am not too sure that we shouldn't really repeal 901 [of the NDEA] and turn the responsibility over to NASA or some agency capable of doing the job. The Science Information Service for ten years now has made nothing more than a token effort. 53/

However, no further legislative action took place on Pucinski's bill.

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52/ U.S. Congress. House. Committee on Education and Labor. Subcommittee on Education. National science research data processing and information retrieval system. Hearings, 91st Congress, 1st session, on H.R. 8809. April 29 and 30, 1969. Washington: U.S. Govt. Print. Off. 1969. p. 25.

53/ Ibid., p. 141.

In March and April of 1969, the House Committee on Science and Astronautics held its first authorization hearing designed to look at the activities of the National Science Foundation. Dr. Burton W. Adkinson, Head of the Office of Science Information Service, testified before the Daddario subcommittee on the responsibilities and programs of his office. Extensive material regarding the contracts and support functions of OSIS also was inserted into the hearing record. However, there was very little questioning directed towards him regarding the differing priorities given OSIS support and coordination functions, and no mention of how OSIS interacted with COSATI or other high-level groups in existence at that time.

Later testimony by William T. Knox, Vice President of McGraw Hill and President of the Information Industry Association, called attention to the evolving role of the commercial information industry and the lack of Federal funding to support its innovative and user-response efforts. Knox indicated that since the great bulk of U.S. scientists and engineers engaged in research and development (71 percent) are employed in private industry, the information systems sponsored by OSIS should be directed toward their scientific information needs. Instead, he asserted, OSIS funding efforts had largely been channeled toward professional society information programs and systems which tended to offer a "library-oriented, archival approach", whereas the commercial information industry was better suited to serve the types of users demanding a variety of information services tailored to their specific needs. 54 /

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54 / U.S. Congress. House. Committee on Science and Astronautics. Subcommittee on Science, Research, and Development. 1970 National Science Foundation Authorization. Hearings, 91st Congress, 1st session. March 17, 18, 20, 24-28 and April 1, 1969. Washington: U.S. Govt. Print. Off., 1969. p. 480.

Knox indicated that changes in funding patterns would not be enough. He agreed that there would be no better place in the executive branch for such an office as OSIS than NSF, but he stated that since the impact of OSIS actions affected far more groups than the university community alone, "its policies and programs with respect to this issue should be subjected to scrutiny by OST, PSAC, and the Congress". 55/ Furthermore,

> It is time that OSIS' mission objectives be redefined. The world has changed greatly since it was set up. There is less concern about access to foreign literature (although large ongoing programs continue in this area). The commercial information industry is much readier to play an active role. And discipline-oriented systems appear less relevant to the multidisciplinary problems facing our society.
>
> ... I believe OSIS' policies and programs would be strengthened by giving one of the new statutory assistant directors of NSF major responsibilities for information matters. 56/

Since these 1970 hearings, there has been very little congressional attention to the issues surrounding the management and funding of scientific and technical information.

The former members who have shown an interest in the topic of scientific information, as noted earlier, have either retired from the Congress or have directed their attention elsewhere. With the gradual decrease and elimination of organizations responsible for making STINFO policy or coordinating the supply and management of scientific information (COSATI, OST, and SIC), there are very few remaining opportunities where Congress can exercise its oversight authority in this area.

It should be noted that in early March 1975, Reps. Olin E. Teague and Charles A. Mosher, the chairman and ranking minority member of the

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55/ Ibid., p. 676.

56/ Ibid.

House Committee on Science and Technology, introduced a new bill which included a separate title on the issue of scientific information. Title IV of this bill, H.R. 4461, proposes the creation of a Government Corporation for Science and Technology Information and Utilization. As of this writing, H.R. 4461 has not been reported from committee.

## V. SUMMARY OF FINDINGS

The strength and viability of our Nation's scientific and technical information services -- both within the Federal Government and the private sector -- have attracted the attention of the Congress from time to time. Since the late fifties, Members and committees of Congress have taken action resulting in measures creating certain information programs, performed traditional oversight by examining department and agency programs, and held hearings designed to focus on salient information handling problems and practices.

Yet the importance of scientific and technical information as a national resource has only recently emerged. It is difficult for non-technical personnel to understand that one of the most significant products of the sizable Federally-funded research and development programs is information. These voluminous data and accompanying narrative insights, presented in varying forms, can be fully utilized only through a strategy for their generation, management, and disposition. This strategy is not apparent in today's STINFO operation. To fulfill these interlocking tasks implies the presence of an assertive leadership, aware of the complex needs of this post-industrial, civilian-oriented society and dedicated to ensuring that that combination of authority, responsibility, and flexibility necessary to carry out this priority mission is functioning. Today, there is a widely alleged lack of such leadership, suggesting strongly that "management" of a precious resource is fragmentary and questionable at best.

What should be the nature of such leadership and how should it be served by advisory mechanisms, representing both the "offerors",

"users", and "managers" of information? Recommendations have been forthcoming from commissioned studies and gatherings of the leaders of the community concerning the desirability of creating a strong coordinating mechanism, which would involve resources of both scientific and non-scientific, public and private groups. The consensus was that such a body must be prepared to implement policies which serve the needs of Government, industrial, and university STINFO activities. More specifically, emphasis would be placed on optimizing cooperation and minimizing duplication in such areas as:

- o creating the type of linkages (e.g., on-line networks) which improve cooperation between information centers, traditional libraries, those who publish, and the varied user groups.
- o operation of indexing and abstracting services, the issuance of primary journals and more innovative dissemination mechanisms.
- o reducing overlap between and maximizing capabilities of services offered both by Federal information systems and their private sector (both profit and non-profit) counterparts.

Many agencies of the Federal Government, it is alleged, have tended to become preoccupied with their own programs and resist cooperative endeavors -- "clinging to prerogatives" was the term employed by one Congressman -- resulting in a feudal posture which impeded the realization of national goals. The private sector groups, whether "wholesalers" or "retailers" of information, understandably want to have a say in determining their own future, or to put it another way, "They don't want to be surprised."

With the disappearance of COSATI, OST, and the Science Information Council, management mechanisms are few. As noted above, there is

an often articulated need for a new organization capable of performing deliberative, analytical tasks as well as simply monitoring and coordinating. In other words, more than a forum for information exchange was visualized. The composition of this advisory organization should be broadly representative of the key elements making up the STINFO community, but not hinged upon specific organizations or specialties: professional society representatives, managers of STINFO activities and R & D "laboratories", information/telecommunications scientists, scientists and engineers in the roles of producers and consumers, managers from information industries, and that genre comprised of policy and program analysts. With this representative mix, the benefits to be derived from a formal advisory mechanism could result in decision-making more attuned to the real world and the opportunity for meeting interdisciplinary, social needs would seem to be greater.

The options related to this projected coordinating body have been enumerated at various times. A filtering of those would bring forth this kind of composite recommendation:

- o an advisory group reporting directly to the President's Science Adviser in his role as Director of NSF, thus being able to meet national responsibilities under Title IX of the National Defense Education Act.
- o a membership of senior, prestigious personnel, numbering less than a dozen, supported by a high quality professional staff.
- o creation of this group in the immediate future, possibly with a legislated mandate, with the potential of imbedding it in any future reconstituted S & T office connected to the White House.

With this type of ingrained expertise and secretariat, the advisory group not only could review the past and monitor the present, but provide guidance responsive to projected needs and goals. Its arena would include providing factual and interpretive contributions to those engaged in high-level policymaking and such "shirt-sleeves" functions as determining information exchange criteria (both inter-system and international), identifying "deliverables" from existing systems, hammering out long-needed standards, calculating long-range user needs, and employing innovative information technologies. To iterate a point made earlier, each action area must be viewed as a "tie-point" to reality, with no time for academic niceties.

In highlighting the priority functions of this advisory group, the past must serve as prologue in attempting to avoid pitfalls -- for example, responsibility for providing coordinative leadership, but no real authority -- and capitalize upon already existing, thoughtful recommendations. Judging from a study of special reports, proceedings from now-defunct advisory group meetings, and records of interviews with key community personnel, a series of essential duties are suggested:

1. Offering advice, based on analysis and deliberation, suitable for shaping policy, executing program review and assessment, and budgeting preparation;
2. Developing lasting but flexible monitoring and coordinating procedures, including a "feedback" capability to ensure responsiveness;
3. Evaluating, in detailed fashion, existing STINFO services and products, particularly in terms of their quality and broad availability, and publishing these findings;



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4. Periodically looking at Federal Government and private sector information services with an eye to user needs, expressed in terms of quality of product, cost, and competitive stance;
5. Working to ensure a reasonable balance in Federal funding of Government and non-Government R & D in information services.
6. Performing and contracting research and development on scientific and technical information products, services, and systems; and
7. Providing an interface with private and international STINFO activities.

Assuming the establishment of an action-oriented advisory group, then the mission and program objectives of the NSF Office of Science Information Service could merit re-examination.

Budget levels for scientific and technical information services have often been tied in theory -- but never in fact -- to overall R & D expenditures. Various witnesses and commentators have offered figures ranging from three to ten percent as a "proper balance". As noted, however, overall agency STINFO figures (using the NSF survey) account for less than three percent of Federal R & D expenditures. The annual decrease in OSIS budget allotments over the last few years also raises questions regarding that Office's capabilities to exercise any planning or coordination functions in the Federal or non-Government environment for scientific and technical information.

Because of newly defined national goals and objectives, Government and society have new requirements for information relevant to STINFO services. There is an increasing urgency for the Congress, OMB, the Federal STINFO community, and the diverse university-society-industry

triad to have a focus for shaping their programs, R & D requests, budgets, and for maximizing the use of existing and future information resources. In response to this need for information and the relatively fragmented structure of existing STINFO systems, a series of questions have emerged during this study for consideration by the Special Subcommittee:

- Is there a requirement today for Government oversight of private sector information services, including those originally subsidized by Federal funds?
- Would it be valuable to obtain testimony from key STINFO figures -- both at the policymaking and operational levels -- in order to update the overall perspective of the Government management role, which might be helpful in modifying or reinforcing past recommendations for improvement of service?
- Does the National Science Foundation view its management and coordination roles as achievable in the light of the sharp decrease (in the 1970 decade) in its OSIS personnel and funding support?
- Could a balanced view of the "health" of (both public and private) STINFO services and responsibilities in terms of developing optimal "systems" responsive to national goals and international commitments be attained by convening a congressionally-sponsored colloquium?
- With Federal budgetary pressures demanding a close scrutiny of all Governmental expenditures, would an assessment of the service provided the full range of user groups by existing information services be helpful in developing guidelines which might eventually result in a better "mix" of such public and private sector services and systems?

- Inasmuch as there is a continuing need to alert and educate key executive and legislative leadership personnel to trends-over-time in STINFO requirements and services, would it be useful to have NSF release for general distribution those recent studies thus far restricted?

## APPENDIX A
## LIST OF ACRONYMS FOR KEY STINFO ORGANIZATIONS

| | |
|---|---|
| ASTIA | Armed Services Technical Information Agency |
| CFSTI | Clearinghouse for Federal Scientific and Technical Information |
| COSATI | Committee on Scientific and Technical Information |
| COSI | Committee on Science Information |
| DDC | Defense Documentation Center |
| FACSI | Federal Advisory Committee on Scientific Information |
| FCST | Federal Council for Science and Technology |
| NCLIS | National Commission on Libraries and Information Agency |
| NSF | National Science Foundation |
| NTIS | National Technical Information Service |
| OSIS | Office of Science Information Service |
| OST | Office of Science and Technology |
| OTS | Office of Technical Services |
| PSAC | President's Science Advisory Committee |
| SATCOM | Committee on Scientific and Technical Communication |
| SDC | System Development Corporation |
| SIC | Science Information Council |
| SIS | Science Information Service |
| SSIE | Smithsonian Science Information Exchange (formerly SIE) |
| UNISIST | World Science Information System (U.N.E.S.C.O.) |
| VINITI | All-Union Institute of Scientific and Technical Information (U.S.S.R.) |

## APPENDIX B

## CHRONOLOGY OF SELECTED EVENTS

1950 - Passage of the National Science Foundation Act

1957 - Creation of the President's Science Advisory Committee and the position of the White House Science Adviser

1958 - Passage of the National Defense Education Act (which created the Science Information Council and Office of Science Information Service in NSF)

- President's approval of the plan proposed by PSAC (Baker report)

- Senate Government Operations Committee (Humphrey subcommittee) holds hearings on the organization and coordination of science activities in the Federal government ("Progress Report in Science Programs")

1959 - President Eisenhower's letter to NSF requesting implementation of the recommendations from the Baker plan

- establishment of the Federal Council for Science and Technology

- establishment of interdepartmental committee, the Federal Advisory Committee on Scientific Information

- hearings by the House Science and Astronautics Committee on the general question of the dissemination of scientific information

1960, 1961 - Senate Government Operations Subcommittee publishes two consultative analyses (Wenk and Stern studies) of the coordination of scientific information from Federal R and D

- same subcommittee adopts statement of policy based on these analyses; Humphrey's criticism on use of "model T" methods by agencies

1962 - Office of Science and Technology created in the Executive Office of the President

- Crawford report submitted to the Science Adviser

- Federal Council creates the Committee on Scientific Information which replaces FACSI

1963 - PSAC-Weinberg report released

- House Education and Labor ad hoc subcommittee holds hearings on the Science Information Service and a proposal for a Scientific Information Data Processing Center (Pucinski hearings)

1964 - Federal Council approves new charter for committee on scientific and technical information which replaces COSI

- Two panels of the House Select Committee on Government Research examine the handling by Federal agencies of scientific and technical information (hearings include a summary progress report prepared by COSATI)

- COSATI review of agency expenditures for STI (not published)

- continuation of Pucinski hearings

- Senator Humphrey introduces a resolution providing for the establishment of a Presidential advisory staff on the management of STI

1965 - COSATI task force report submits partial report studying the national document-handling system (prepared with assistance of SDC)

- House Science and Astronautics hearings on government and science, including a review on NSF activity in science information (Daddario subcommittee)

1966 - Denial of additional staff person for OST to coordinate a network of STI systems, and departure of COSATI chairman Knox

- House Science and Astronautics Committee examines NSF and separately, bills to provide for a standard reference data system

1967 -

1968 - COSATI review of agency expenditures for STI (not published)

1969 - NAS publishes a report of its committee on scientific and technical communication (SATCOM)

- House Science and Astronautics holds first authorization hearings on NSF

1970 -

1971 - Last COSATI annual report published

- COSATI moved to NSF under agreement that OSIS would assume administrative responsibility and provide supporting staff

1972 - OST ad hoc group prepares report on Federal agency expenditures for STI (not published)

- FCST task force prepares report on management of STI (not published)

1973 - Organization for Economic Development publishes report forecasting information needs in 1985 (Anderla report)

- Re-organization Plan No. 1 takes effect, transfers advisory functions of OST to NSF

1974 - OSIS prepares and announces new program plan

- Science Information Council holds last meeting

## APPENDIX C

## SYNOPSES OF MAJOR REPORTS

PSAC-Baker Panel Report December 1958

IMPROVING THE AVAILABILITY OF SCIENTIFIC AND TECHNICAL INFORMATION IN THE UNITED STATES. A report of the President's Science Advisory Committee. December 7, 1958.

This report recommended that the National Science Foundation expand its scientific information program to constitute a Science Information Service that would serve to aid and coordinate existing government and private efforts.

The report was included in the hearings on "Missile Development and Space Sciences", held by the House Committee on Science and Astronautics in February, 1959.

Members of the Committee included:

Dr. James R. Killian, Jr. (Chairman), Special Assistant to the President for Science and Technology

Dr. Robert F. Bacher, professor of physics, California Institute of Technology

Dr. William O. Baker, vice president (research), Bell Telephone Laboratories

Dr. Lloyd V. Berkner, president, Associated Universities, Inc.

Dr. Hans A. Bethe, professor of physics, Cornell University

Dr. Detlev W. Bronk, president, Rockefeller Institute for Medical Sciences, and president, National Academy of Sciences

Dr. James H. Doolittle, vice president, Shell Oil Co.

Dr. James B. Fisk, executive vice president, Bell Telephone Laboratories

Dr. Caryl P. Haskins, president, Carnegie Institution of Washington

Dr. George B. Kistiakowsky, professor of chemistry, Harvard University

Dr. Edwin H. Land, president, Polaroid Corp.

Dr. Edward M. Purcell, professor of physics and Nobel laureate, Harvard University

Dr. Isidor I. Rabi, professor of physics and Nobel laureate, Columbia University

Dr. H. P. Robertson, professor of physics, California Institute of Technology

Dr. Paul A. Weiss, Rockefeller Institute for Medical Science

Dr. Jerome B. Wiesner, director, Research Laboratory of Electronics, Massachusetts Institute of Technology

Dr. Herbert York, Chief Scientist, Advanced Research Projects Agency, Department of Defense

Dr. Jerrold R. Zacharias, professor of physics, Massachusetts Institute of Technology

Science Adviser -- Crawford Report April 1962

SCIENTIFIC AND TECHNOLOGICAL COMMUNICATION IN THE GOVERNMENT. Task force report to the President's Special Assistant for Science and Technology, April 1962.

The task force chaired by Dr. James H. Crawford was appointed by Science Adviser Wiesner to examine Federal information programs. It made two major recommendations to improve the flow of scientific and technical information within the Federal Government. First, a central authority should be established for policy and supervision of these activities, and second, each agency with research and development interests should establish an office to direct and control information activities. Their report emphasized engineering, organizational, and management changes in the Federal information activities, rather than improvement of specific systems.

The report was reproduced by the Armed Services Technical Information Agency as Report AD-299-545. Reprinted also in "National Information Center", hearings before the Ad Hoc Subcommittee on a National Research Data Processing and Information Retrieval Center of the House Committee on Education and Labor, 88th Cong., 1st sess., 1963, appendix to vol. 1, pp. 21-107.

Members of the task force were:

Dr. James H. Crawford, Jr., Associate Director, Solid State Division, Oak Ridge National Laboratory (Chairman)

Gregory Abdian, Director of Research, Institute for Advancement of Medical Communication

Willard Fazar, Assistant for Advanced Management Systems, Navy Special Projects Office

Sidney Passman, Physical Scientist, Rand Corp.

Robert B. Stegmaier, Jr., Staff Assistant, Office of the Director of Defense Research and Engineering

Joshua Stern, Chief, Basic Instrumentation Section, National Bureau of Standards

PSAC - Weinberg Panel Report January 1963

SCIENCE, GOVERNMENT AND INFORMATION: THE RESPONSIBILITY OF THE TECHNICAL COMMUNITY AND THE GOVERNMENT IN THE TRANSFER OF INFORMATION. A report of the President's Science Advisory Committee. January 10, 1963.

The panel found that transfer of information is an inseparable part of research and development. Its report recommended that "each Federal agency concerned with science and technology must accept its responsibility for information activities in relevant fields, and must devote an appreciable fraction of its talent and other resources to support of information activities." Supporting recommendations of the panel included two relating to the White House science structure. One recommended that "the entire network of Government information systems should be kept under surveillance by the Federal Council for Science and Technology". The other was that "problems of science information should be given continued attention by the President's Science Advisory Committee".

The panel's report offered about 200 specific recommendations. This was less a national plan for handling information than a set of principles upon which action might be based. The development of specialized information centers and assignment of delegated agents were suggested. Closer teamwork with scientists was advocated.

Panel members included:

Alvin M. Weinberg (Chairman), Director, Oak Ridge National Laboratory

William O. Baker, vice president (research), Bell Telephone Laboratories

Karl Cohen, manager, advanced engineering, atomic power experiment department, General Electric Co.

James H. Crawford, Jr., editor, Journal of Applied Physics, Oak Ridge National Laboratory.

Louis P. Hammett, Mitchill professor emeritus of chemistry, Columbia Unversity

A. Kalitinsky, program director, NOVA, General Dynamics/Astronautics

Gilbert W. King, director of research, IBM Research Center

William T. Knox, manager (planning), Esso Research & Engineering Co.

Joshua Lederberg, Stanford University Medical Center

Milton O. Lee, executive secretary, Federation of American Societies for Experimental Biology

John W. Tukey, professor of mathematics, Princeton University, and associate executive director, Bell Telephone Laboratories

Eugene P. Wigner, Thomas D. Jones professor of mathematical physics, Princeton University

COSATI-Recommendations and SDC report November 1965

RECOMMENDATIONS FOR NATIONAL DOCUMENT HANDLING SYSTEMS IN SCIENCE AND TECHNOLOGY. Includes Appendix A, Volumes I and II, A background study prepared by the System Development Corporation. PB 168 267, AD 624 560. November 1965.

This report was prepared by an ad hoc task group from the Committee on Scientific and Technical Information, at the request of the Chairman of FCST. The purpose of the report was to develop a conceptual framework for an improved national network of information systems in science and technology, with particular emphasis on a close relation between research and development and the information systems in science and technology.

Appendix A is a background study, prepared by SDC at the request of the COSATI Task Group. This report contains recommendations for a national document-handling system in science and technology, with a description of problems in the scientific and technical information and document area, and a set of principles and requirements for a national system. The preferred system and four alternative approaches are developed and evaluated.

Members of the COSATI Task Group included:

William T. Knox, Chairman
Burton W. Adkinson
Walter M. Carlson
Melvin S. Day
Ellis A. Johnson
Foster E. Mohrhardt
Donald A. Schon
John Sherrod
Andrew A. Aines, Secretary

NAS-SATCOM report June 1969

SCIENTIFIC AND TECHNICAL COMMUNICATION: A PRESSING NATIONAL PROBLEM AND RECOMMENDATIONS FOR ITS SOLUTION. A report of the Committee on Scientific and Technical Communication of the NAS-NAE. June 1969.

The Committee was established in February of 1966, in response to the NSF's request of October 20, 1965, to investigate the present status and future requirements of the scientific and engineering communities with respect to the flow and transfer of information. The SATCOM report proposed 55 recommendations, which were considered essential for the effective communication of scientific and technical information. A primary recommendation was the establishment of a Joint Commission on Scientific and Technical Communications, responsible to the Councils of NAS and NAE, and various other coordinating commissions.

The recommendations of the Committee reflect a firm conviction that generators and users of scientific and technical information must assume increasing responsibility for the more effective transfer of such information.

Members of the Committee included:

Robert W. Cairns, Chairman

Jordan J. Baruch
Curtis G. Benjamin
Raymond L. Bisplinghoff
Daniel I. Cooper
Ralph L. Engle, Jr.
Conyers Herring
George E. Holbrook
Donald I. Katz
J.C.R. Licklider
Clarence H. Linder
Jerome D. Luntz
H. W. Magoun
Oscar T. Marzke
Nathan M. Newmark
William H. Pickering
Byron Riegel
William C. Steere
Don R. Swanson
John W. Tukey
Marie A. Tuve
Paul Weiss
W. Bradford Wiley
Irving S. Wright
Van Zandt Williams

FCST (NSF) - Greenberger report June 1972

MAKING TECHNICAL INFORMATION MORE USEFUL: THE MANAGEMENT OF A VITAL NATIONAL RESOURCE. A report for the Chairman of the FCST submitted via the Director of the NSF. June 1972. Not published.

The report was prepared by a Review Group, set up in December 1971 by the Chairman of FCST and the Director of NSF. This Group was requested to examine the organization, programs, and possible future roles of COSATI, which had been shifted in 1971 from OST to NSF. The Review Group was also requested to take a broad look at the technical information programs and policy issues both in and outside of government, including the impact of new developments in computer and communication technology.

In its conclusions, the Review Group found that progress had been made by COSATI in achieving greater operational coordination among agencies in the technical information field, but that serious deficiencies existed in the government's approach to broader policy issues. The report identifies some major problems, and recommends organizational changes that will improve the government's capability to address these problems. Included in these changes are the establishment of an Information Policy Board in the Executive Office of the President, and the creation of a Federal Technical Information Committee also in EXOP. These two new bodies would supersede SIC and COSATI.



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The Review Group included:

| | | |
|---|---|---|
| Chairman | Martin Greenberger | The Johns Hopkins University |
| Members | Joseph Becker | Becker and Hayes |
| | Harvey Brooks | Harvard University |
| | Walter M. Carlson | IBM Corporation |
| | Fred C. Cole | Council on Library Resources |
| | W. Conyers Herring | Bell Telephone Laboratories |
| | Jerome D. Luntz | McGraw Hill Publications Company |
| | F. Karl Willenbrock | National Bureau of Standards |
| Advisors | William O. Baker | Bell Telephone Laboratories |
| | Caryl Haskins | Washington, D.C. |
| | Herbert A. Simon | Carnegie-Mellon University |
| | Alvin M. Weinberg | Oak Ridge National Laboratory |
| Executive Secretary | S. A. Rossmassler | National Bureau of Standards |

## APPENDIX D

### SCIENCE INFORMATION SERVICE
Actual and estimated program obligations 41/
Fiscal years 1953 - 1976

| Fiscal Year | Program Totals | Request to OMB | OMB Adjustment | Request to Congress |
|---|---|---|---|---|
| 1953..... | $184,919 | | | |
| 1954..... | 217,595 | | | |
| 1955..... | 403,339 | | | |
| 1956..... | 404,563 | | | |
| 1957..... | 904,749 | | | |
| 1958..... | 1,937,551 | | | |
| 1959..... | 3,847,527 | | | |
| 1960..... | 5,370,340 | | | |
| 1961..... | 6,406,089 | | | |
| 1962..... | 9,201,294 | | | |
| 1963..... | 10,329,754 | | | |
| 1964..... | 10,861,000 | | | |
| 1965..... | 11,290,000 | | | |
| 1966..... | 11,620,000 | | | |
| 1967..... | 10,025,000 | | | |
| 1968..... | 14,396,000 | | | |
| 1969..... | 10,664,451 | | | |
| 1970..... | 11,433,279 | | | |
| 1971..... | 10,695,000 | | | |
| 1972..... | 9,710,922 | | | |
| 1973..... | 8,464,408 | | | |
| 1974..... | 8,100,000 | 12,500,000 | -4,200,000 | 8,300,000 |
| 1975(est).. | 5,000,000 | 8,300,000 | -3,300,000 | 5,000,000 |
| 1976(est).. | 6,000,000 42/ | | | |

41/ Data for fiscal years 1953-63 from Table 13 in "National Science Foundation -- A General Review of its First 15 Years". U.S. Congress. House. Committee on Science and Astronautics, Subcommittee on Science Research and Development. January 24, 1966. p. 185.

Data for fiscal years 1964-73 from "Independent offices appropriations for 1966-1975". Hearings before a subcommittee of the House Committee on Appropriations.

Data for fiscal years 1974-76 from U.S. Budget, Appendix. FY 1976.

42/ In the budget submitted to Congress for fiscal year 1976, science information service is no longer broken out as a separate program category, but is subsumed under a larger category, titled national and special research.

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APPENDIX E

NATIONAL SCIENCE FOUNDATION

WASHINGTON, D.C. 20550

# TOWARD NATIONAL COORDINATION OF SCIENTIFIC AND TECHNICAL INFORMATION THROUGH RESEARCH AND DEVELOPMENT

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## OFFICE OF SCIENCE INFORMATION SERVICE

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Presented by

Dr. Lee G. Burchinal, Head
Office of Science Information Service
National Science Foundation

37th Annual Meeting
American Society for Information Science
Atlanta, Georgia

October 15, 1974

## Toward National Coordination of Scientific and Technical Information Through Research and Development

### Statutory Base

The initial legislation that established the National Science Foundation also authorized science information activities for fostering the interchange of scientific information among scientists in the United States and foreign countries.

As part of its efforts to strengthen science in the United States, in 1958 Congress considerably expanded this authority (Title IX, National Defense Education Act) by directing the Foundation to:

(1) ... "provide, or arrange for the provision of indexing, abstracting, translating, and other services leading to a more effective dissemination of scientific information."

(2) ... "undertake programs to develop new or improved methods, including mechanized systems, for making scientific information available."

NSF has always chosen to implement this legislative mandate by arranging for the provision of improved means for disseminating scientific information, and not by operating science information services of its own.

### Past Activities

Much of OSIS past efforts were devoted to strengthening and expanding the science information services of the professional scientific and technical societies. For example:

- Start-up funds were provided to establish 18 new scientific journals.
- Over 70 translation journals and services (mainly from the Russian and Chinese literature) were started.
- Initial funding was provided to establish major national science information services, such as the Science Information Exchange (now SSIE) and the National Referral Center for Science and Technology at the Library of Congress.
- Seven major discipline-oriented abstracting and indexing services (chemistry, physics, biology, geology, engineering, mathematics, and psychology) received assistance in computerization of their operations.

- o Partial support was also provided for development of seven university-based computerized systems for searching the machine-readable files of Federal and private abstracting and indexing services.

- o And, research on basic information science problems was supported.

Most of the OSIS budget was committed to supporting a small number of large, multi-year projects. For example, of 200 multi-year projects supported by OSIS, seven in the years between FY 1969 to FY 1973 consumed 50 percent of the OSIS annual expenditures.

While OSIS support has helped to create the most advanced science information systems in the world, the size, complexity, and diversity of systems and services today demand a different kind of Federal commitment to science communication.

Current Problems

Typical of the important problems facing science communications today are:

- o Inadequate means for coping with the steadily increasing rate of scientific publication--the literature growth rate has been about eight to ten percent per year for the past several decades, but OECD estimates suggest a four- to sevenfold increase by 1985.

- o Abstracting and indexing services are falling behind in coverage of the world's literature--the mean growth rate of these services is under four percent, but the literature rate of growth is conservatively twice that figure. In addition, inflationary forces are further cutting into productive capacity.

- o Generation of numerical data is exceeding critical analysis and dissemination processes--the volume of published numerical data comprises 15-20 percent of the literature and is growing in direct proportion with that literature, while large but unknown amounts of data are being collected and stored in data banks.

- o Poor communication exists between information suppliers and users--users, libraries, and information centers must keep abreast with the information products and services of thousands of suppliers in Federal agencies, scientific and technical societies, and for-profit firms. Moreover, they are confronting a much wider diversity of materials, including printed matter, computer tapes, microfilm, audio-visual materials, etc.

- The cost of materials continues to rise--scientific publishers and abstracting services have repeatedly raised prices in recent years; prices for chemistry and physics journals, for example, increased 86 percent between 1967 and 1972.

- A large and diverse population of users must be served--one estimate indicates a 20 to 30 percent increase in scientists in the next decade; and more people in business, industry, and government are becoming secondary users of scientific and technical information.

- A pressing need has emerged for cross-disciplinary information systems--Federal information systems are designed to meet mission requirements, while those of scientific and technical societies are designed to support specific disciplines. Consequently, in broader areas like environment or energy we are not equipped to meet new information needs.

- Emerging technologies and networking are forcing major system changes--while the strong trend toward resource sharing among libraries, information centers, and universities offers great promise, there are serious questions as to how networks will ultimately affect the economic balance existing between information suppliers and users.

- The effects of information on national productivity are poorly understood analytically--if nearly 40 percent of the Gross National Product can be accounted for by the production, distribution, and use of knowledge, as some estimates indicate, increasing productivity in the U. S. depends greatly upon more efficient and effective application of available knowledge.

New Directions

The problems mentioned above have exposed serious deficiencies in our present system of science communication. As a result, costs for many services are unnecessarily high, and frequently users are unable to find the information they need. We lack a national strategy for attacking the Nation's science information problems systematically. By redirecting its programs, OSIS hopes to "spearhead" the development of such a strategy.

The "new" OSIS program is aimed at stimulating improvements in the scientific and technical information transfer process, and consists of three inter-related parts:

- Research and development--to stimulate needed cost/effective and innovative improvements;

- o Leadership activities--to promote the application of information retrieval research and development results and the introduction of related promising improvements; and

- o Coordination among Federal and private services--to foster standards, minimize duplication of effort, and simplify user access.

Research. No longer will major support be provided for establishing, maintaining, or expanding specific information services. OSIS funds, instead, are being used to produce generalizable results that can help improve methods of acquiring, transmitting, retrieving, and using information in any scientific or technical area. OSIS activities are designed to advance the state of the art in science communication. Furthermore, OSIS support is limited to efforts that will serve the public interest and that are not supportable by other public or private organizations. Although unsolicited proposals are welcomed and reviewed on their merits, proposals aimed at specific OSIS research objectives are being especially encouraged.

OSIS research goals and objectives are being widely disseminated to assist researchers in targeting their proposals to recognized problems. Also, OSIS has released a program solicitation for FY 1975 and has issued several requests for proposals.

Leadership. OSIS will exercise its leadership in two ways. First, it will actively disseminate information about its research in progress and completed research. Second, OSIS hopes to help shape national directions by initiating planning conferences involving relevant Federal agencies and other public and private groups.

Coordination. Fundamental, long-term improvements in information transfer, however, require new initiatives that are beyond OSIS's present capabilities. For this reason, OSIS has proposed forming a new science information advisory body to fill the void created by the demise of COSATI and the expiration of the Science Information Council. The advisory group would work with OSIS to coordinate key science information programs and to develop a common set of research goals and objectives for long-term communication improvements.

Substantial improvements in our information systems cannot be attained by edict. But through research, leadership, and voluntary coordination OSIS believes that national objectives in this area can be achieved. No national plan is being proposed, as in the United Kingdom, Canada, West Germany, Japan, the U.S.S.R., and some other countries. Rather, OSIS is attempting to set in motion integrating actions, based on guidance derived from research.

The next section sets forth the conceptual framework for the new OSIS program plan and elaborates OSIS research and development objectives.

Conceptual Framework for Science Information R&D

Information services are not ends in themselves; they are means to the broader end of helping individuals and organizations to attain their goals and to improve their performance. Information services do this by helping individuals work more productively through use of all relevant available knowledge.

Productive use of information rests upon two sets of conditions: (1) timely, assured access to needed information, preferably at one's place of work; and, (2) an environment that promotes effective use of the retrieved information. These conditions, however, cannot be achieved unless we improve our management of the flow of information from thousands of points of origin to the even more numerous points of application.

OSIS Role

OSIS is in a unique position to provide data and guidance for improving the management of R&D results because (1) it does not operate any system and has no vested operational interests; and (2) it is charged by Congress to improve science communication. Consequently, beginning in FY 1975, OSIS will structure its research and development program in such a way that its results can help improve the overall management of scientific and technical information services in the United States. In addition, the program is designed to facilitate improvements in access to, and use of, R&D results. Figure 1 depicts the conceptual relationships among management, access, and use, and illustrates how their respective contributions can be used to advance national goals and strengthen organizational performance. The three criteria being used to assess the effectiveness of information systems are also shown. These are (1) enhancement of organizational performance, and (2) cost-effectiveness and (3) user-responsiveness of services. The output of the new OSIS research and development program will be measured against these criteria. Figure 2 describes the 17 research goals derived by OSIS for guiding work on the management, access, and use functions.

Considerable investment--far beyond the resources available to OSIS or any other organization--will be required to attain these goals. Nevertheless, by offering a comprehensive set of goals for achieving significant gains in scientific and technical communication, OSIS hopes to stimulate national debate on the issues involved. Results of the debate may include consensus on certain critical issues and directions (goals) for national improvements.

FIGURE 1

OVERVIEW OF LONG-RANGE COOPERATIVE
NATIONAL SCIENCE AND TECHNICAL INFORMATION PROGRAM

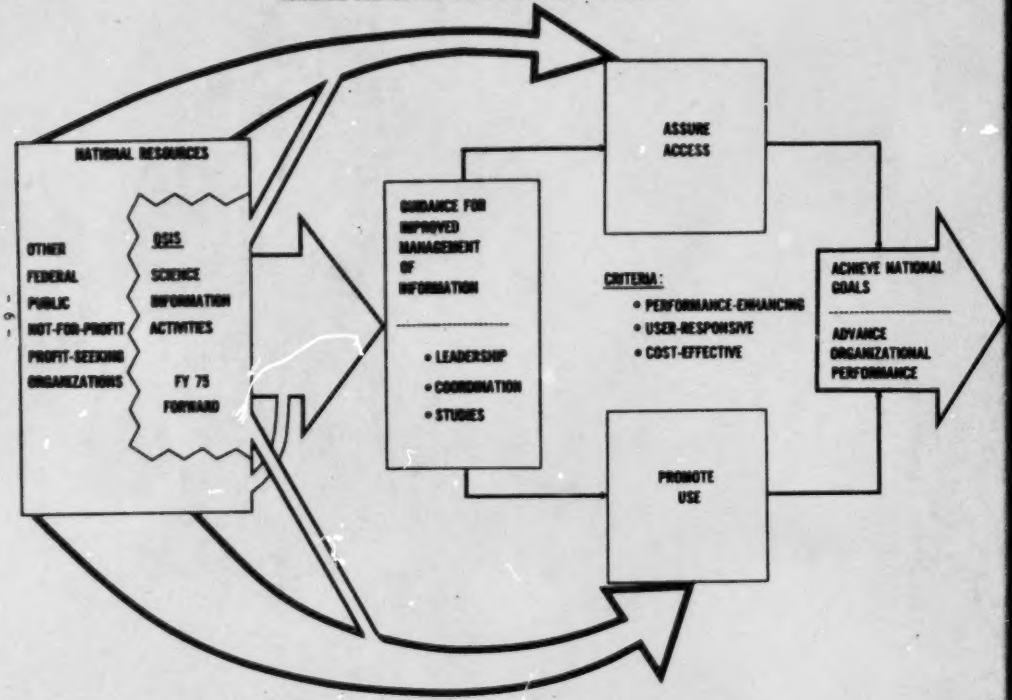
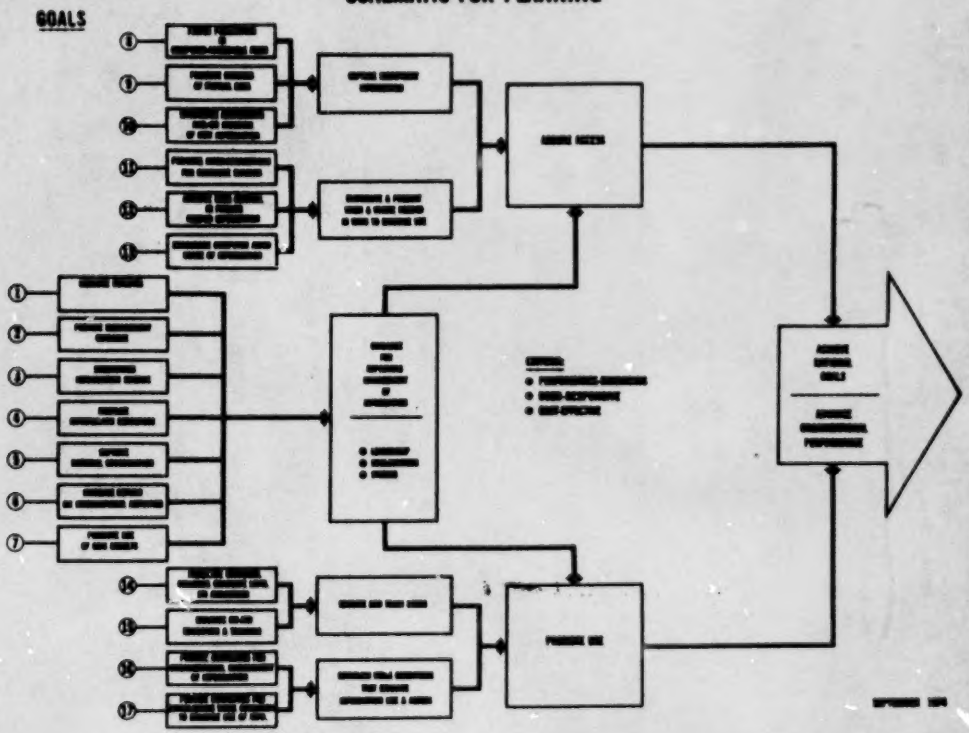


FIGURE 2

OFFICE OF SCIENCE INFORMATION SERVICE

## SCHEMATIC FOR PLANNING



With such agreement, OSIS will be better able to stimulate R&D on critical national science information problems, to promote effective coordination among public and private services, and to accelerate the application of tested improvements in science communication. OSIS is committed to building this kind of partnership with the Nation's major scientific and technical information services.

Meanwhile, however, OSIS is using the present set of goals to guide solicitation, review, and monitoring of proposals and projects.

The following three sections present goals for each of the three areas--management, access, and use--of scientific and technical information.

## GUIDANCE FOR IMPROVED MANAGEMENT OF INFORMATION

The aim of research in this area is to produce data and knowledge that can be used to improve methods for transferring, accessing, and using scientific and technical R&D results. Research is needed to illuminate present and near-future options for improving distribution, access, and use functions; for facilitating short-run improvements; and for identifying promising lines of development for fundamental, long-term advances in services.

In this context, OSIS has established seven goals, the achievement of which will provide guidance for improving the management of scientific and technical information in the United States. Foremost is the need to measure benefits from information use. Without hard data on the value of information services, alternatives cannot be assessed and managers are unable to make cost/effective decisions. Closely related is the need to provide managers of services--the suppliers or distributors--with data to help them design and market those products and services for which there is high demand. The purpose is to facilitate emergence of user-responsive, innovative, and economically viable services based on advanced state-of-the-art methods. But more fundamental changes may also be needed as well. Therefore, a third aim is to support development of new theoretical approaches and models for advanced information transfer systems. Such research is being developed in ways to strengthen information science as a scientific discipline and to foster generation of new hypotheses and theories in the field of information.

The recent energy crisis demonstrated how poorly scientific and technical information is organized. Consequently, using the energy R&D field as a test case, OSIS has set as a fourth goal--the testing of new methods for mobilizing scientific and technical information to meet national needs. Expanding the requirements for coordination, OSIS has set as its fifth goal improving coordination among the public and private organizations which comprise

the Nation's information enterprise. In today's world, however, national coordination must also be viewed in an international context. The sixth goal, therefore, is to examine how U.S. interests can be furthered while they also contribute to international objectives. Finally, if key decision-makers and managers who control the operation of U.S. scientific and technical information services are to benefit from results of OSIS R&D, they must know about these findings. Therefore, OSIS has embarked upon a vigorous dissemination program.

The first set of OSIS goals then are:

(1) To Measure Benefit from Information Use. Information managers assert that information services are vital to the advancement of science and technology, but hard data to substantiate this thesis are scarce. High priority, therefore, must be given to developing new methods for measuring the benefits of information services in terms of their positive contribution to decision-making in the scientific, technical, managerial, and policy areas.

Three approaches are being pursued. First, OSIS staff is analyzing the literature. Second, research proposals are being encouraged for the collection and analysis of relevent data. For example, a program solicitation recently issued by the Foundation on science information issues stressed this need. Third, the topic is under study in a cooperative project with the U.S.S.R.

(2) To Provide Guidance for Improved Management of Scientific and Technical Information Services. In this area, studies and experiments focus on generating reliable data on the cost-effectiveness and user-responsiveness of information services and guidelines for actions for assuring their economic viability. Particular attention is be given to organizing data on production, flow, use, pricing, and marketing of scientific and technical information. Part of this work is cooperative with the Office of Exploratory Research and Problem Assessment of the Research Applications Directorate and with the Division of Science Resources Studies of the Education Directorate.

(3) To Strengthen Information Science as a Scientific Discipline. Research on fundamental information science issues constitutes the most basic work supported by OSIS. Two major lines of activity are being explored. One consists of research on basic information science problems and the formulation of theories and mathematical models for information transfer. The other focuses on applied research to convert basic findings into prototype developments. Some cooperative work in this area is being conducted with the Office of Exploratory Research and Problem Assessment of the Research Applications Directorate.

(4) To Mobilize Existing Information Resources to Meet Emerging National Needs. New methods for organizing energy

R&D information are being studied. The purpose is not only to help meet immediate needs for energy R&D information, but also to learn how to mobilize information resources to meet future critical needs. Specifically, four kinds of research are underway: (1) to aggregate energy R&D information from many computer-based bibliographic retrieval systems into one energy file; (2) to improve the indexing of energy R&D literature by developing common terminology among energy R&D information services; (3) to assess the value of computer conferencing as a technique for rapidly coordinating and mobilizing information resources to meet unanticipated and sudden national needs; and (4) to develop contingency plans for meeting new interdisciplinary information requirements, especially those of decision-makers.

(5) To Improve National Coordination Among Scientific and Technical Information Services. This includes provision for assessing the health of the Nation's scientific and technical information enterprise, stimulating communication within the Federal scientific and technical information community and between the Federal and private sectors, and use of an advisory body for encouraging coordination among information services.

(6) To Increase the Net Return on International Activities. Here, OSIS is seeking to establish performance criteria to help guide U.S. participation in international science information programs. The purpose of activities in this area is to increase the interchange of scientific and technical information between the U.S. and other countries. Major OSIS activities include participation in the world-wide cooperative science information program of UNESCO (UNISIST), and the initiation of a set of bilateral cooperative projects with the U.S.S.R.

(7) To Promote Use of OSIS-Sponsored Results and Other Innovations. The OSIS dissemination process begins with an announcement of new awards, followed by the distribution of summaries of all awards made each fiscal year. In addition, OSIS has begun a series of symposia for the analysis and dissemination of research results from OSIS sponsored research. As part of its leadership function, OSIS also includes dissemination of information about innovations developed with support from sources other than OSIS.

## ASSURING ACCESS TO INFORMATION

Timely access to R&D results depends on (1) the availability of information organized in machine-retrievable form and on (2) means for distributing this information to users in their own working environments. The "capture," "distribution," and "presentation" functions rest heavily upon technology. In each case, however, economic, administrative, and user preference issues weigh heavily as well.

Six interrelated goals have been identified for "assuring access" to information. The first is to stimulate publication in machine-readable form. Simultaneously OSIS is pursuing a second goal, the banking of factual data. Together, work toward these two goals will help produce a machine-retrievable record of the results of scientific and technical R&D. Third, for ready access to both literature and data, present abstracting-indexing services have to be extended from their present literature orientation to comprehensive scientific and technical information access services.

Along with organizing information in machine-readable form, attention must also be given to improving capabilities for distributing and presenting information to users. Therefore, OSIS intends to pursue three additional avenues of work. One calls for stimulating the development of resource-sharing networks capable of delivering data or literature. The second is directed toward arrangements whereby users can direct their own network searches to retrieve needed information. The third is concerned with helping users manipulate and otherwise derive value from retrieved information.

(8) To Foster Publication in Computer Accessible Form. Experiments are supported to explore electronic publishing and to find new ways by which small publishers can pool their resources to achieve an operational scale great enough for computerization. Specific research to meet this objective includes testing the operation of a shared editorial processing center serving two or more professional societies; and experimentation with electronic publication to the virtual exclusion of paper or microform publication.

(9) To Promote the Banking of Factual Data. Numerical or factual results of scientific observation and measurement must be available for retrieval and presentation in the same way literature is today. To this end, data must be compiled and stored in data banks that are widely accessible to potential users. Three specific sets of efforts are being supported: (1) development of worldwide inventories of major data centers and data banks; (2) encouragement of data management policies that will make data more available; and (3) stimulation of new methods for routinely capturing data in a standard, machine-readable form at the point of publication.

(10) To Encourage the Abstracting and/or Indexing of New Information. Work includes demonstrating ways of incorporating data descriptive records into abstracts of scientific publications, extending abstracting and indexing coverage to the contents of data banks, and eliminating unnecessary duplication among abstracting-indexing services in their coverage of primary literature.

(11) To Foster the Development of Networking among Scientific and Technical Information Services. In this connection, OSIS is stimulating the evolution of a set of linkages that begins with resource sharing among abstracting and indexing services in the

U.S. and that can be later extended to major foreign systems. Network developments will be encouraged in ways to allow for successive incorporation of the output of publishers, data banks, and other information producers and distributors. OSIS is not funding the development or operation of networks. Instead, support is limited to facilitating the interconnection of networks in a coordinated and reasonably cost/effective manner. OSIS emphasis, therefore, is directed toward (1) encouraging operational compatibility among services, (2) supporting the development of standards, and (3) facilitating linkages and resource-sharing among suppliers, distributors, and users of machinebased information. This effort is conducted jointly with the Division of Computer Research of the Foundation's Research Directorate.

(12) To Advance User Control in Finding Needed Information. Research is probing new methods for searching and extracting information from distant computer files using remote computer terminals. Work is expected to proceed from testing ways to retrieve information remotely from structured files, as an engineering handbook, to retrieval of data and, ultimately, conceptual material from the full texts of documents.

(13) To Encourage Computer-Aided Usage of Information. The objective of this research goal is to test the thesis that users can direct searches, locate and manipulate retrieved information, analyze, interpret, compose, and communicate all from the same computer terminal. Specific forms of computer-assistance would include aids for preparing manuscripts, solving engineering design problems, facilitating statistical analyses, and developing planning and policy options. In this instance, activities will be developed jointly with other programs and private groups.

## PROMOTING USE OF INFORMATION

There are two essential prerequisites to ensuring the productive use of information. First, the prospective user must be prepared and educated to use information resources effectively. Second, organizations must be guided to acquire and organize information and information services that are relevant to the needs of their constituents.

OSIS hopes to exert positive influences on both prerequisites. In this context, OSIS has identified four program goals to structure work for promoting effective use of information. Two focus on preparing individuals to use information as part of their career development. These are:

(14) To Facilitate College and Graduate-Level Awareness of Scientific and Technical Information Services. As a first step, OSIS is engaged in the development of training materials and curricula suitable for use within existing science, mathematics,

and engineering curricula. Research in this area will be developed in cooperation with the Education Directorate of the Foundation. Results will be assessed by organizations not associated with the development.

(15) To Enhance On-the-Job Education and Training of Scientists and Engineers. Beginning in FY 1975, OSIS expects to be able to begin cooperative development of on-the-job training programs with industrial and professional organizations. Conventional printed and audio-visual approaches will be tried, including computer-assisted instruction.

The final two goals, which focus on stimulating changes in working environments that will foster productive use of information, are:

(16) To Provide Guidelines for Management of Scientific and Technical Information Services within Organizations. Activities include analyses and experiments designed to help managers increase the range and diversity of information sources required by their R&D personnel. Access by infrequent users in small organizations that cannot afford large scale, computer-based services will receive special attention. Other research will focus on information access problems in large organizations.

(17) To Provide Guidelines for Establishing Work Conditions that Enhance the Useful Application of Information. In this case, emphasis is on increasing information use at the bench level for scientists and engineers. Plans call for analyzing existing arrangements and for introducing and assessing experimental variations in ways that will increase use of information. The results of these analytical studies will be used to develop experiments for testing alternative ways of overcoming obstacles to use of information. For both goals 16 and 17, initial work is focused on users in industrial settings. As results permit, work will be expanded to governmental, higher education, and other settings.

## NEXT STEPS

The foregoing program plan represents a solid base for OSIS operations in FY 1975 and planning for FY 1976. Further work, however, is needed to ensure that the OSIS program optimally serves the scientific community and even broader national interests. To refine and strengthen this program plan, OSIS is:

- Seeking comments and review from the science and engineering communities and from scientific and technical information experts and organizations.



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Through a series of working conferences run by an independent, but vitally interested professional organization, OSIS expects to receive constructive criticism of its program and recommendations for new initiatives.

- o Conducting, in collaboration with the Foundation's Office of Planning and Resources Management, an assessment of the Foundation's science information program from 1950 through Fiscal Year 1973. The results of this effort will be used to review OSIS goals and objectives and the strategies and methods for attaining them.

- o Actively soliciting views of NSF management and other Federal agencies on needs for improvement in science communication.

Using input from these and other sources, OSIS staff will continue to refine and strengthen the OSIS program plan, and will seek guidance from the Science Information Council and any subsequent advisory body.

## APPENDIX F

## BIBLIOGRAPHY

U.S. National Science Foundation. Annual report 1973. NSF 74-1. Washington, U.S. Govt. Print. Off., 1974. 122 p.

___. Annual report 1972. NSF 73-1. Washington, U.S. Govt. Print. Off., 1973. 102 p.

___. Federal funds for research, development, and other scientific activities. Fiscal years 1972, 1973, and 1974. Surveys of science resources series. NSF 74-300. Volume XXII. Washington, U.S. Govt. Print. Off., 1974. 61 p. Detailed statistical tables, appendices C. and D. 145 p.

___. Federal funds for science. Fiscal years 1960, 1961, and 1962. Surveys of science resources series. NSF 61-82. Volume X. Washington, U.S. Govt. Print. Off., 1962. 145 p.

___. An analysis of Federal R & D funding by function. Fiscal years 1963-1973. Surveys of science resources series. NSF 72-313. Washington, U.S. Govt. Print. Off., 1972. 83 p.

U.S. National Science Foundation. Office of Science Information Service. The growth of scientific and technical information -- a challenge. Lecture and seminar proceedings. J. Georges Anderla. January 1974. 63 p.

___. To improve access and use of scientific and technical information. October 1974. 11 p.

___. Improved dissemination and use of scientific and technical information. Program solicitation. October 1974. 8 p.

___. Current research and development in scientific documentation. Number 15. NSF-69-8. 1969. 741 p.

___. Non-conventional scientific and technical information systems in current use. Number 4. Washington, U.S. Govt. Print. Off. December 1966. 558 p.

U.S. Federal council for Science and Technology. Committee on Scientific Information. Status report on scientific and technical information in the Federal government. June 18, 1963. [1963] 18 p.

___. Standard for descriptive cataloguing of Government scientific technical reports. December 1963.

___. Proceedings, Second Symposium, technical information and the Federal laboratory, April 13-14, 1964. [1964]. 88 p.

___. Summary progress report. September 1964. In U.S. Congress. House. Select Committee on Government Research. Study No. IV. Documentation and dissemination of research and development results. Report of the ... 88th Cong. 2d sess. 1964. 148 p. At Appendix A, pp. 101-108.

U.S. Federal Council for Science and Technology. Committee on Scientific and Technical Information. Special analysis of the President's FY 1966 budget for scientific and technical information programs of Federal government agencies. Washington, D.C. 1964. 31 p.

___. Recommendations by the Committee on Scientific and Technical Information for National Document Handling Systems in Science and Technology (and a companion report by the System Development Corp., vols. I and II), November 1965. NTIS PB 168 267. 20 p. plus appendix.

___. Progress of the United States Government in scientific and technical communications. 1965 annual report. NTIS PB 173 510. 1965. 42 p.

___. Progress of the United States Government in scientific and technical communications. 1966 annual report. NTIS PB 176 535. 1966. 35 p.

___. Progress of the United States Government in scientific and technical communicatons. 1967 annual report. NTIS PB 180 867. 1967.

___. Selected mechanized scientific and technical information systems. Prepared for the Panel on Operational Techniques and Systems by Herner and Company. Washington, D.C. April 1968. 143 p.

___. Committee on Scientific and Technical Information. Scientific and technical information programs of Federal agencies. Washington, D.C. 1968.

___. Progress in scientific and technical communications. 1968 annual report. NTIS COSATI-69-5 PB 186 400. 1968. 90 p.

___. Recommendations for improving the dissemination of Federal scientific and technical information. Report of the task group on dissemination of information. Washington, D.C. December 1969. 141 p.

___. Progress in scientific and technical communications. 1969 annual report. NTIS PB 193 386. 1969. 156 p.

___. Directory of Federally supported information analysis centers. Sponsored by Panel 6, Information Analysis and Data Centers. NTIS COSATI-70-1 PB 189 300. January 1970. 71 p.

___. Recommendations for improving the dissemination of Federal scientific and technical information. Report of the task group on dissemination of information. Washington, D.C. July 1970. 124 p.

___. Recommendations for improving the dissemination of Federal scientific and technical information. Report of the task group on dissemination of information. Washington, D.C. November 1970. 127 p.

___. Making technical information more useful: The management of a vital national resource. A report for the Chairman of the FCST submitted via the Director of the National Science Foundation. June 1972. 61 p.

U.S. Office of Science and Technology. Federal agency obligations for management, processing, and transfer of scientific and technical information, data, and technology. Fiscal year 1969 to fiscal year 1973. Report of the ad hoc group. September 1972. Volumes I, II and III.

U.S. President's Science Advisory Committee. Improving the availability of scientific and technical information in the United States; a report of the President's Science Advisory Committee, December 7, 1958. In U.S. Congress. House. Committee on Science and Astronautics. Missile development and space sciences. Hearings ... 86th Congress, 1st session. February 2 - March 12, 1959. Washington, U.S. Govt. Print. Off., 1959, 492 p. At pp. 381-387.

___. Science, Government, and information: the responsibilities of the technical community and the government in the transfer of information; a report of the President's Science Advisory Committee, January 10, 1963. Washington, U.S. Govt. Print. Off., 1963, 52 p.

U.S. Department of Commerce. Office of Technical Services. Scientific and technological communication in the government. Task force report (Crawford report). April 1962. AD 299545. 81 p.

National Academy of Sciences. Scientific and technical communication: A pressing national problem and recommendations for its solution. A report by the Committee on Scientific and Technical Communication of the NAS-nAE. Washington, D.C. 1969. 322 p.

Organisation for Economic Co-operation and Development. Information in 1985: A forecasting study of information needs and resources. Georges Anderla. 1973. 131 p.

___. Reviews of national science policy: United States. Paris 1968. 546 p.

U.S. Congress. House. Committee on Education and Labor. Ad Hoc Subcommittee on a National Research Data Processing and Information Retrieval Center. National information center. Hearings on H.R. 1946, 88th Congress, 1st sess. May, July, and September 1963. Washington, U.S. Govt. Print. Off., 1963. Volume 1, Parts 1, 2, and 3. 679 p. Appendix to Volume 1, Parts 1, 2, and 3. 508 p.

___. National information center. Hearings on H.R. 1946, 88th Cong., 2d sess. April and August, 1964. Washington, U.S. Govt. Print. Off., 1964. Part 4. p. 681-893.

___. General Subcommittee on Education. National science research data processing and information retrieval system. Hearings on H.R. 8809, 91st Cong., 1st sess. April 29 and 30, 1969. Washington, U.S. Govt. Print. Off., 1969. 405 p.

U.S. Congress. House. Committee on Government Operations. Research and development. Part 1 - Background testimony. Hearings, 85th Cong., 2d sess. January 15-17, 28, 29; February 3, 4, and 12, 1958. Washington, U.S. Govt. Print. Off., 1958. 329 p.

___. Availability of information from Federal departments. Eleventh report by the committee. 87th Cong., 1st sess. Washington, U.S. Govt. Print. Off., 1961.

___. Subcommittee on Military Operations. The Office of Science and Technology. A report prepared for the subcommittee by the Science Policy Research Division, Legislative Reference Service, Library of Congress. 90th Cong., 1st sess. March 1967. Washington, U.S. Govt. Print. Off., 1967. Committee print. 326 p.

U.S. Congress. House. Committee on Science and Astronautics. Subcommittee on Science, Research, and Development. Missile development and space sciences. Hearings, 86th Cong., 1st sess. February, March 1959. Washington, U.S. Govt. Print. Off., 1959. 492 p. (Baker report included on p. 381-387.)

___. The National Science Foundation -- a general review of its first 15 years. Report of the committee prepared by the Science Policy Research Division, Legislative Reference Service, Library of Congress. 89th Cong., 2d sess. January 24, 1966. Washington, U.S. Govt. Print. Off., 1966. House Rpt. No. 1219. 286 p.

___. The National Science Foundation -- its present and future. Report of the committee. 89th Cong., 2d sess. February 1, 1966. Washington, U.S. Govt. Print. Off., 1966. House Rpt. No. 1236. 118 p.

___. Bill to provide standard reference data system. Hearings, on H.R. 15638 superseded by H.R. 16897, June 28-30, 1966. 89th Cong., 2d sess. Washington, U.S. Govt. Print. Off., 1966. 181 p.

___. Centralization of Federal science activities. Hearings, 91st Cong., 1st sess. Washington, U.S. Govt. Print. Off., 1969.

___. Policy issues in science and technology: review and forecast. Third progress report of the subcommittee. 90th Cong., 2d sess. Washington, U.S. Govt. Print. Off., 1968. 54 p.

___. Centralization of Federal science activities. Hearings. 91st Cong., 1st sess. Washington, U.S. Govt. Print. Off., 1969.

___. Centralization of Federal science activities. Report to the subcommittee. 91st Cong., 1st sess. Washington, U.S. Govt. Print. Off., 1969.

___. 1970 National Science Foundation Authorization. Hearings, 91st Cong., 1st sess. March 17, 18, 20, 24-28; April 1, 1969. Washington, U.S. Covt. Print. Off., 1969. Volume I, 751 p. Volume II, 628 p.

___. Toward a science policy for the United States. Report of the subcommittee. 91st Cong., 2d sess. October 15, 1970. Washington, U.S. Govt. Print. Off., 1970. 115 p.

U.S. Congress. House. Select Committee on Government Research. Administration of R and D grants. Study I. 88th Cong., 2d sess., July 31, 1964. Washington, U.S. Govt. Print. Off., 1964. H. Rpt. No. 1729. 106 p.

___. Documentation and dissemination of R and D results. Study IV. 88th Cong., 2d sess., November 20, 1964. Washington, U.S. Govt. Print. Off., 1964. H. Rpt. No. 1932. 148 p.

___. Staff resume of the activities of the committee. Study X, Part II. 89th Cong., 1st sess., February 18, 1965. Washington, U.S. Govt. Print. Off., 1965. H. Rpt. No. 1941, Part 2. 78 p.

U.S. Congress. Senate. Committee on Government Operations. Science and technology act of 1958. Analysis and summary prepared by the staff. 85th Cong., 2d sess. Washington, U.S. Govt. Print. Off., 1958. S. Doc. No. 90. 198 p.

___. Progress report on science programs in the Federal Government. Committee report, 85th Cong., 2d sess. September 9, 1958. Washington, U.S. Govt. Print. Off., 1958. S. Rpt. No. 2498.

___. Science program. Committee report, 86th Cong., 1st sess. Washington, U.S. Govt. Print. Off., 1959. S. Rpt. No. 120.

___. Documentation, indexing and retrieval of scientific information. 86th Cong., 2d sess. Washington, U.S. Govt. Print. Off., 1960. S. Doc. No. 113. 283 p.

___. Documentation, etc. Addendum to S. Doc. No. 113. 87th Cong., 1st sess. Washington, U.S. Govt. Print. Off., 1961. S. Doc. No. 15. 22 p.

___. Subcommittee on Reorganization and International Organizations. Coordination of information on current scientific research and development. Committee report, 87th Cong., 1st sess., May 18, 1961. Washington, U.S. Govt. Print. Off., 1961. S. Rpt. No. 263. 286 p.

___. Coordination of information on current Federal research and development projects in the field of electronics. 87th Cong., 1st sess. September 20, 1961. Washington, U.S. Govt. Print. Off., 1961. 292 p.

___. Federal budgeting for research and development. Hearings, 87th Cong., 1st sess., July 26 and 27, 1961. Parts I and II. Washington, U.S. Govt. Print. Off., 1921, 1962. 434 p.

___. Interagency coordination of information. Hearings, 87th Cong., 2d sess., Parts I and II. Washington, U.S. Govt. Print. Off., 1963. 242 p.

## APPENDIX G

## PROJECT CONTACTS WITH STINFO COMMUNITY (1974-1975)

Burton W. Adkinson
Former Head
Office of Science Information Service
National Science Foundation

Andrew A. Aines
Senior Staff Associate
Office of Science Information Service
National Science Foundation

Lee G. Burchinal
Head, Office of Science Information Service
National Science Foundation

Carlos A. Cuadra
General Manager
SDC Search Services
System Development Corporation

Martin S. Cummings
Director
National Library of Medicine

Melvin M. Day
Deputy Director
National Library of Medicine

Eugene Garfield
President
Institute for Scientific Information

Martin Greenberger
Director Information Science
Johns Hopkins University

David F. Hersey
President
Smithsonian Science Information Exchange

William T. Knox
Director
National Technical Information Service

Samuel Lazerow
Vice President, Administration
Institute for Scientific Information

Eugene Pronko
Staff Associate
Office of Science Information Service
National Science Foundation

Harold Pryor
Scientific and Technical Information
National Aeronautics and Space Administration

Stephen A. Rossmassler
Office of Standard Reference Data
National Bureau of Standards

Hubert E. Sauter
Administrator
Defense Documentation Center

Roger K. Summit
Manager, Information Systems Program Office
Lockheed Missiles and Space Co., Inc.

Peppino Vlannes
Scientific and Technical Information
National Aeronautics and Space Administration

Edward Wenk, Jr.
Program for the Social Management of Technology
University of Washington

Figure 3. Federal Organizations with Significant Scientific and Technical Information and Documentation Activities